AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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VOLUME 21. NEW YORK, THURSDAY, APRIL 7, 1898. NUMBER 14.

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Sulzer Brothers.—A Swiss Engine Shop.

The American who is in the habit of thinking and of asserting that everything American is and must of necessity be infinitely superior to anything not American, and especially that our form of government is the best on earth and cannot be improved upon, should go to Switzerland, not merely to "go up the Alps and down the Rhine" but to study and to learn how much better some things can be done than we do them.

A venerable and learned English archdeacon recently said in a public address that "Switzerland is the school of Europe in all that constitutes true political and social welfare." No less ought it to be the school of America in some things, for nothing seems more certain than that Switzerland has evolved the most democratic form of government now existent. That is to say, a government by which the people really rule, and rule by the exercise of their best intelligence and with a high regard for the common welfare.

Before proceeding to a description of some of the things which I saw at Winterthur in one of the most famous engineering establishments in the world I may be pardoned for dwelling a little upon a subject which, though it does not relate specially to machine construction, yet exerts an important influence upon it so far as it is carried on in the Republic of Switzerland.

Long before I went there I had become interested in what is called the Swiss "initiative and referendum," and naturally when I came to meet the engineers and manufacturers of that country I inquired what the effect of that method of legislation was upon manufacturing interests. The uniform reply was that its effect was most favorable. A brief account of this system and of some of the results of it as seen there may be interesting to many, and possibly useful to those who may be called upon to do their share in the work of arriving at wise solutions of some of the civic problems which we here in America must sooner or later solve.

Ours is frequently referred to as a "representative" form of government, as though that of itself were a special virtue. The Swiss form of government is less "representative," and in just that point is superior. There is in Switzerland no field or opportunity for the political boss. The people themselves actually rule there, and a man or an "interest" wishing to secure the passage of a corrupt law or a law opposed to the interests of the Swiss people could not do it by paying a sum of money to a boss owning a working majority of the legislature, nor by purchasing a few legislators' votes, as is notoriously done in some of our State legislatures. He would have to buy up the whole body of the people, which, of course, is impossible and is never attempted. The Swiss, like ourselves, have a President, who, however, has far less power than our own, and they also have their legislative bodies which, so long as they go in accordance with the manifest wishes of the people, are by common consent in most cantons permitted to legislate. But supposing a measure to be presented before this body which may be for any reason objectionable, the Swiss people do not have to write imploring letters to their representatives begging them to vote right, do not have to sign and present petitions, do not have to put up with a law which they feel has been enacted by corrupt influences, nor be forced by a party boss to vote at the next election for the same corrupt legislators. The free-born, patriotic and more or less self-satisfied American citizen has to do all of these things, but not so the Swiss citizen. Supposing such a measure to have been presented to the Swiss legislature, some one or more newspapers would, of course, call attention to the bill and its objectionable features. Thereupon a paper would be started in circulation which, upon receiving a certain number of signatures specified by law, would be duly presented before the legislature, and the legislature would then have no alternative but to submit the proposed law to a vote of the people. After a fixed time, sufficient to permit the law to be brought to the notice of all who may desire to vote upon it and for full discussion, the proposed law is approved or condemned by a vote of the people, the legislature having nothing further to do with it. This compulsory reference to the people of any question upon which they may desire to express their own preference is called the "referendum." The "initiative" is the means by which the people can themselves, if they so desire, draw up and pass a bill which then becomes a law, the legislature, though it may be in session at the time, having little or nothing to do with it.

The above gives in very brief outline the principles of Swiss legislation. The actual procedure varies somewhat in different cantons, and in some of them no law whatever can be passed without the expressed approval of the people.

Those who have given the matter no consideration might conclude from what they see of our own legislatures that we should be pretty busy voting upon laws if we attempted to run the United States on that principle. But the fact is that most of our legislation is State legislation, and, of course, only the people of a State would in any event vote upon any State law. A further fact is that with this system in force there would certainly be far less legislation than there is now, because the impelling influences which now are behind much of our law making would have no chance to act. An important point to be considered also is the fact that the legislators of Switzerland know that under their system no law which is opposed to the wishes of the people can possibly be placed upon the statute books, and that there is, therefore, no use trying to place such a law there. A little reflection will show the very powerful restraining influence of this fact and its discouraging effect upon the "boss" who makes his living out of political corruption, jobbery and thieving.

I quote from an American writer who has made a special study of the institutions of Switzerland and has spent much time there for that purpose, as follows:*

"The masses of the citizens of Switzerland found it necessary to revolt against their plutocracy and the corrupt politicians who were exploiting the country through the representative system. For a peaceful revolution these masses found the means in the working principles of their communal meetings—the initiative

* "Direct Legislation," by J. W. Sullivan.

and the referendum—and these principles they are applying throughout the republic as fast as circumstances will admit.

"No departure from home rule, no privileged individuals or corporations, no special legislation, no courts with powers above the people's will, no legal discriminations whatever—such their aim and in general their successful aim, the Swiss lead all other nations in leaving to the individual his original sovereignty.

"Winterthur, the second town in Zurich, has so many [public] forests and vineyards that for a long period its citizens not only had no taxes to pay, but every autumn each received gratis several cords of wood and many gallons of wine. Numerous small towns and villages in German Switzerland collect no local taxes, and give each citizen an abundance of fuel. In addition to free fuel, cultivable land is not infrequently allotted.

"The members of the communal corporations in Glarus, though not rich, are as free and independent as any other wage workers in the world; they inherit the common lands; their local taxes are little or nothing; they are assured work, if in not in the manufactories then on the land."

Some Americans, accustomed to very different social arrangements, will no doubt be disposed to think that such conditions as have been very briefly and, in fact, inadequately referred to above, would be inconsistent with industrial progress and prosperity. But the fact is that Switzerland is a manufacturing country. Besides other lines of manufacturing, machinery is made there in engineering establishments which are very highly developed and very successful under natural advantages as to supplies of raw material, etc., much inferior to those under which our own machinery building is carried on. The famous establishment which forms the principle subject of this article, for instance, Sulzer Brothers, at Winterthur, gets its iron mostly from England and Scotland, from whence it comes by water to Mannheim, and from thence by rail to its destination. At the time of my visit, which was in June of last year, they had just received a trial consignment of American pig iron, which they were going to try, and thought they might continue to use if it proved suitable for their work. Coal also has to be imported, and comes from Germany, by way of the rivers Saar and Ruhr, its cost being 30 francs or practically $6 per ton. Then after this imported raw material has been worked up into high grade stationary engines and

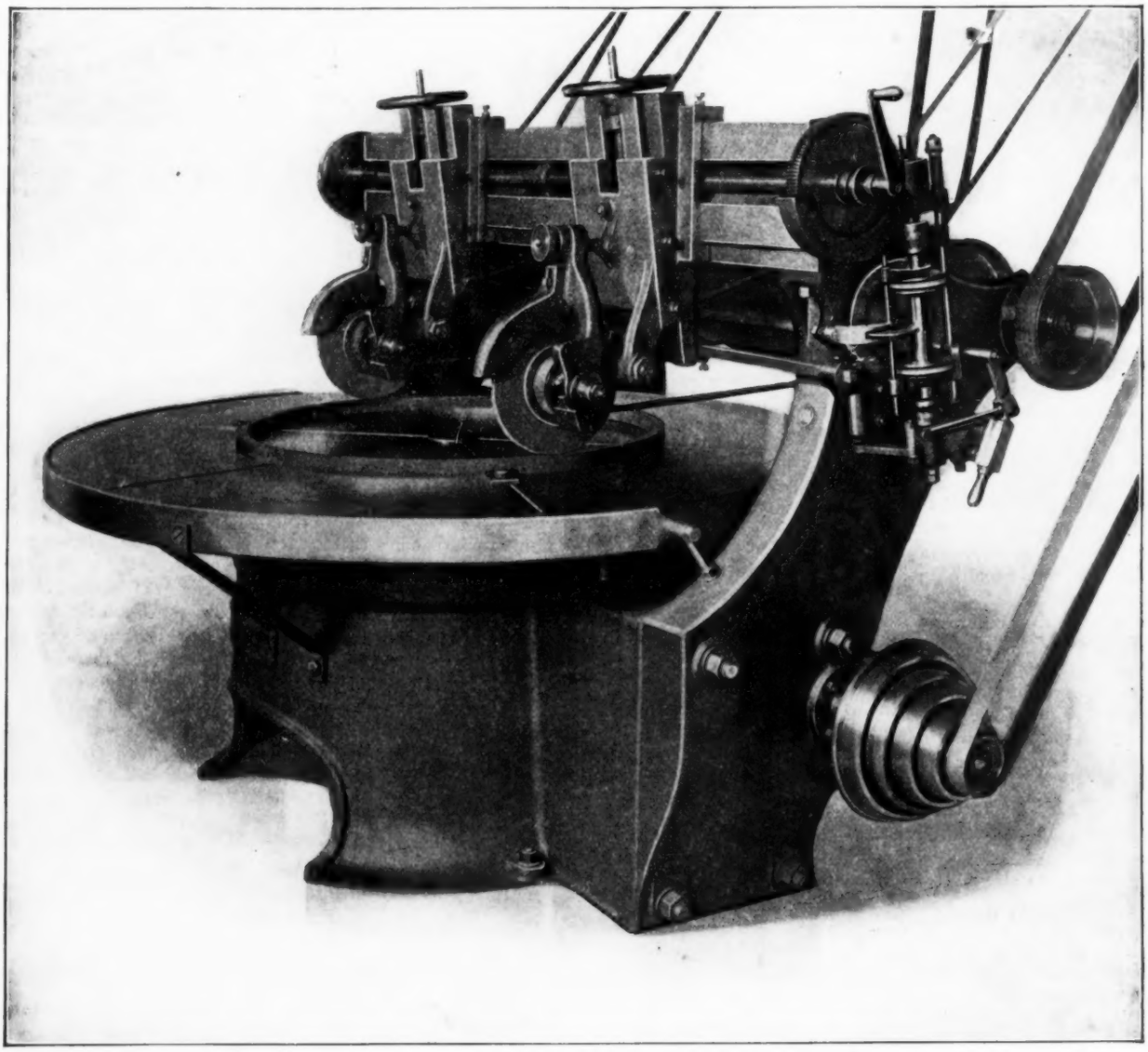

FIG. 1.—PISTON RING GRINDING MACHINE IN THE SULZER SHOPS.

other machinery it must be mostly sold in foreign countries, Switzerland being too small a country to consume the entire product of such a large establishment. Wages are high—higher than in any other Continental country, and about the same as in England.

The fact that this machinery building establishment, carried on under these conditions, has made for itself a reputation second to none other in the world, has grown and made money, shows, it seems to me, either that, in its management there are more and better brains than are to be found elsewhere in manufacturing establishments, or that the political conditions outlined at the beginning of this article are more favorable than those under which the manufacturing of this or any other country is carried on. As to the quality and the quantity of the brains there can be no question, but as a result of my own study of the situation and of inquiry I conclude that the political environment in Switzerland is very favorable to well conducted manufacturing establishments.

I had the pleasure of going about this works with its superintendent—a member of the firm, Mr. Carl Sulzer, who is a member also of our American Society of Mechanical Engineers, and is well informed in regard to American practice. Many American tools are to be seen in the works, and, in answer to a question on that point, I was informed that the men found our American lathes convenient and accurate, and that they liked them. I do not think it is at all correct to say, however, that "half the machine tools to be seen in these shops are of American make and half the remainder foreign copies of American designs." There are quite a number of American lathes and other tools, but the majority of the more important tools are special in character and have been built mostly by Continental builders, partially or wholly to the designs of the Sulzer establishment. Some such tools they have, in fact, constructed themselves, and two of these are shown in the accompanying engravings, the first of which is of a special machine for grinding the sides of piston rings. Mr. Sulzer informed me that they had asked the Brown & Sharpe Manufacturing Company to build this machine, but for some reason, which I do not now recall, they did not care to undertake it. Mr. Sulzer said he therefore felt at liberty to make use of such features of the B. & S. grinding machines as were adapted to the requirements of this special case. The machine might be called a surface grinder, with a rotating instead of a reciprocating platen, and it is, of course, evident that it would be adapted to deal with many other jobs of grinding as well as the particular one specified and for which it was especially constructed.

The action of the machine will be readily understood from the engraving, by which it is seen that the heads are separately driven and fed, and that the feed motion is automatically reversed by means of tappets, which are upon the square bar running along in front and below the cross-rail, this bar throwing the clutches which are driven by the double friction arrangement. The rate of feed is altered by means of the right and left screw in front of the friction pinions, which screw is turned by means of the milled disk attached to it at the center.

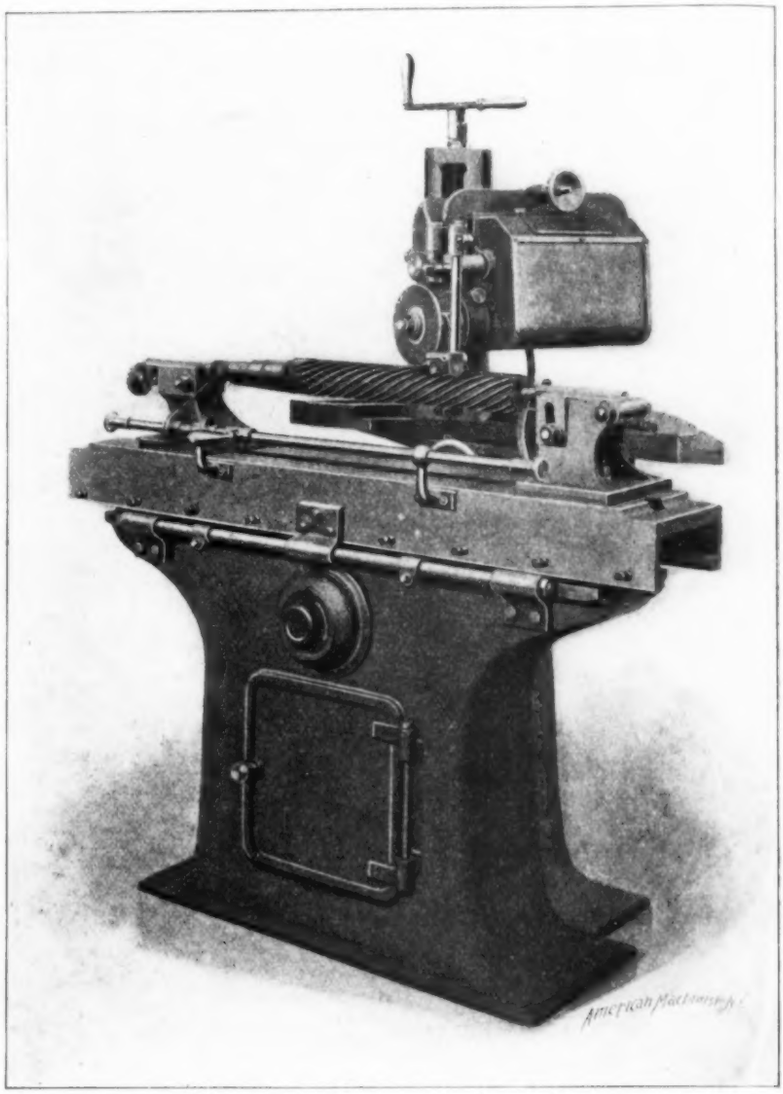

FIG. 2.—CUTTER AND REAMER GRINDER IN THE SULZER SHOPS.

If it should occur to a machinist to think whether or not a spring piston ring would be made wider at its inner edge and correspondingly narrower at its outer edge when sprung together, he would be apt to conclude that this would be the effect really, but that the small amount of springing done on a piston ring would make the deformation of section so small as to be imperceptible and negligible. The action referred to is made quite perceptible by this machine, however, and it is found that unless the rings, when placed upon the platen to be ground, are sprung together as they are to be when in place in the engine cylinder they will not fit the sides of the grooves properly, but will bear only near the inner edges; this notwithstanding the fact that the springing is not more than about 3 per cent. of the diameter.

When these rings are turned they are chucked in a special chuck which is built up on the face plate of a lathe and by means of which the ring is closed and at the same time located upon the plate by means of numerous spring plungers, all equally loaded and applied to the outer surface of the ring so close together as to make it quite certain that the ring is compressed by practically equal forces acting all around its outer circumference, and that, therefore, when it is turned and bored while held in the position thus

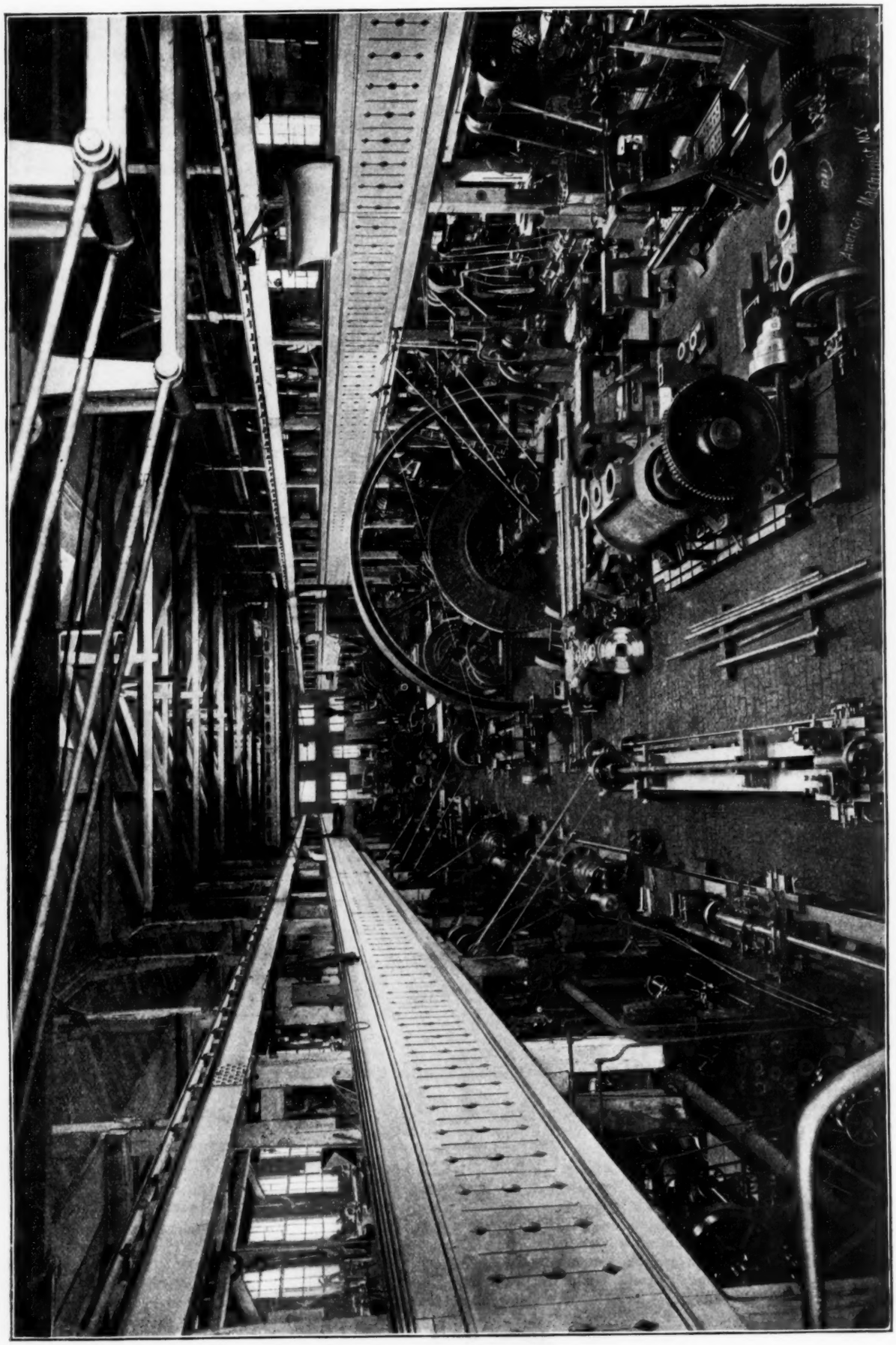

FIG. 3.—SULZER MACHINE SHOP.

given to it, it will afterward press against the cylinder walls with practically equal force at all points.

Another refinement here is seen in the fact that they do not turn their pistons for horizontal engines enough smaller than the bore of the cylinder to give the required clearance and let them go at that; whereby, of course, they can bear only on a narrow line at the bottom. Instead of this, they first turn the piston the same size as the bore of the cylinder; then throw it off the center a little and take a light cut off the high side only, leaving enough of the surface of the first cut to give a good and accurately fitting bearing for a third or more of the circumference of the piston.

Another grinding machine which attracted my attention is for grinding cutters and reamers (Fig. 2). This machine, like the one described above, was also designed and built in the establishment, and is especially unique in the plan adopted for mounting the wheel spindle head and for driving the spindle. The drive is by an electric motor, which is boxed up as shown, this being evidently the most convenient, if not otherwise the best, method of driving, for the reason that the standard which carries the wheel spindle and vertically adjustable saddle moves upon an arc of a circle, the center of which is at the point at which the wheel touches the work. This enables the wheel to be presented at any desired angle, and it is noticeable that any change in the position of the wheel changes also the tooth rest, thus saving much otherwise necessary adjustment of the lathe. The milled disk just above the motor box is for fine vertical adjustment of the wheel after it has been approximately set by means of the vertical screw and slide. A weight, not shown, is attached by a cord to one of the small grooved pulleys, shown in front of the machine, and a cord led from the other pulley, as shown, and passed about the work keeps the tooth being ground against the rest. In Figs. 3, 4 and 5 are shown interior views of the machine shops. In the right foreground of Fig 3 are seen two of the cylinder boring machines.

In the corresponding portion of Fig. 4 is seen the machine by which boring and drilling for the valve seats and for the studs, etc., are done, and the object at the left of this is not a boiler, as might be supposed, but the two cylinders of a compound engine.

At the left-hand side of Fig. 5 is seen one of the special machines referred to, and it is at present engaged on the job of milling the seats for the main bearing of an engine and is making use of a cutter similar to the one seen in the grinder, Fig 2. Behind this machine is another one of special design, having three uprights, two of which are tied together, this machine being, however, nearly concealed by a large cylinder which is being bored in a special machine nearer the observer.

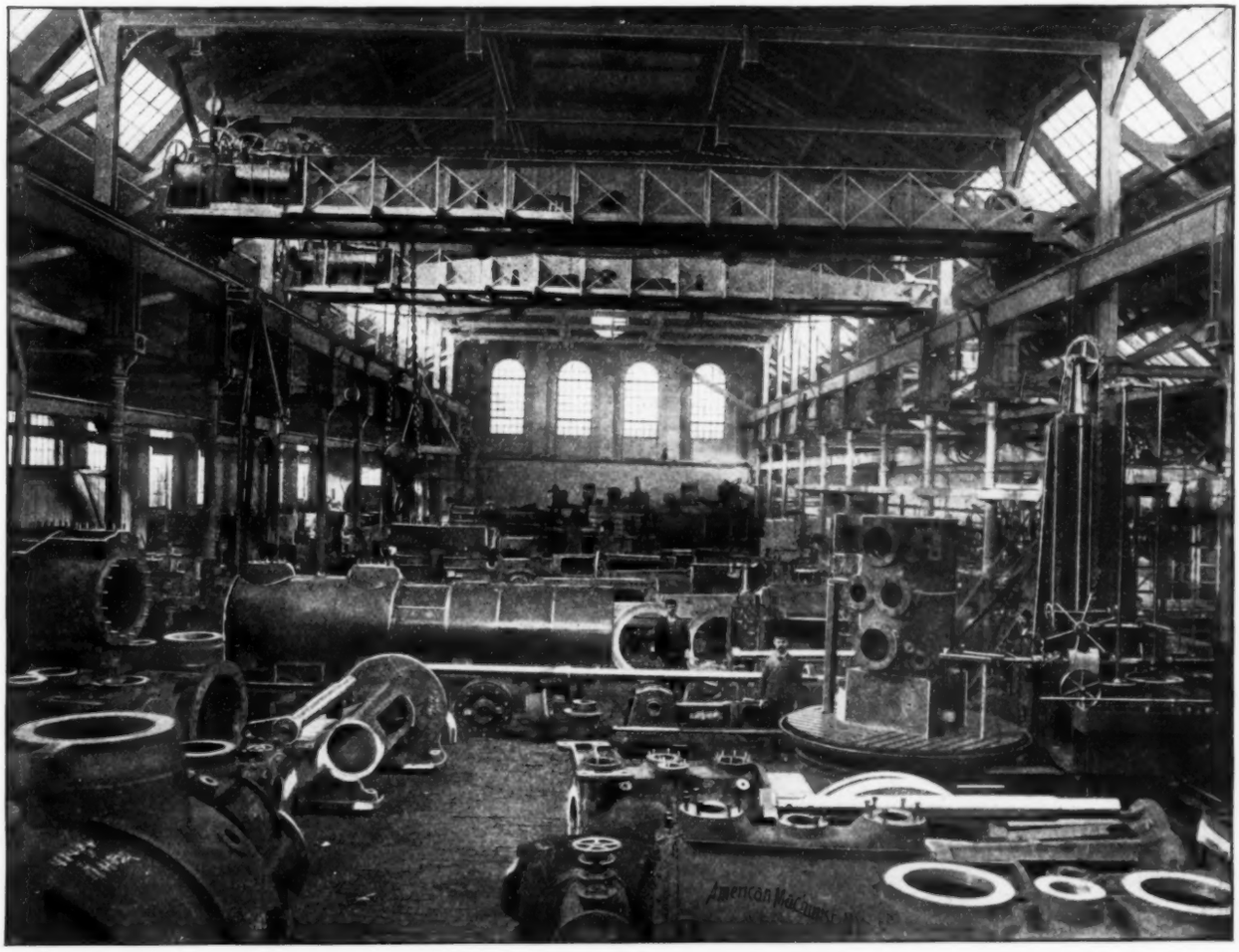

FIG. 4.—SULZER MACHINE SHOP.

A ground plan of the works is given at Fig. 6. About 24 acres of ground are covered by them and nearly three thousand men are employed. There are two locomotives in the yard, one broad and one narrow gage, besides two locomotive cranes, which are also used for moving material; while in the shops there are two cranes of 25 tons capacity,

ten of 20 tons, seven of 15 tons, six of 12½ tons, besides many smaller and uncounted ones. The present establishment was founded by the grandfather of the present owners, but he was preceded by his father, who in 1834 established a brass foundry, which was the real beginning of a business which is now believed to be the largest in the world devoted to the production of steam engines.

In Europe it is sometimes found advisable for business reasons to establish branch works in other countries, so that the products offered for sale can be offered as home productions. For this reason the Sulzers have found it desirable to establish a works at Ludwigshafen, Germany, which works covers 7½ acres of ground and employs 700 men. Mr. Sulzer informed me that the wages paid in the German branch establishment were lower than in Winterthur, but that the cost of production for the same engines was higher. I assume also that it is not the practice to import iron or coal for the German shop, as is done for the Swiss one.

As will be inferred from the parts of engines seen in the various views of the machine shops, the valves of the engines made here and the mechanism for working them differ very radically from the valves and valve gear commonly used here. The valves are of the double-beat, poppet variety, and are lifted from their seats by the valve gear and disengaged and allowed to close at a point in the stroke determined by the governor. The engines are interesting in many ways, and some account of them and of the remarkable steam economy obtainable by them will be found in a paper read by Hamilton A. Hill at the Hartford meeting of the American Society of Mechanical Engineers and printed in Vol. XVIII. of the society's transactions.

The workmanship on these engines is undoubtedly equal to any engine work done elsewhere in the world, and is far superior to most of it. Indeed the outward finish—the polish—seemed to me to be too high to be considered in the very best taste; but this practice of very high polishing is quite general in Continental machine shops, and Mr. Sulzer said they practiced it because it was the custom and was expected on first-classs work, rather than because they themselves liked to see it.

A great deal of milling is done in these shops; much of it on machines especially designed for the work, and a feature of the milling which I especially noticed is that, in the case of face mills with inserted cutters at least, the cutters are so arranged that they cut and not so that they have to remove metal by pushing or jamming it off. Such cutters are triangular in cross-section and are placed in grooves milled in the head, about as shown in the sketch Fig. 7. The two sides of these cutters which have a bearing in the head are ground true and to the proper angle, so that they have a good bearing in the head, and will always go into it alike. A ring which fits over the body of the mill is provided with set-screws which secure the cutters in place. This ring is not shown in the sketch, but is perfectly plain, and I think shrunk on. The screws

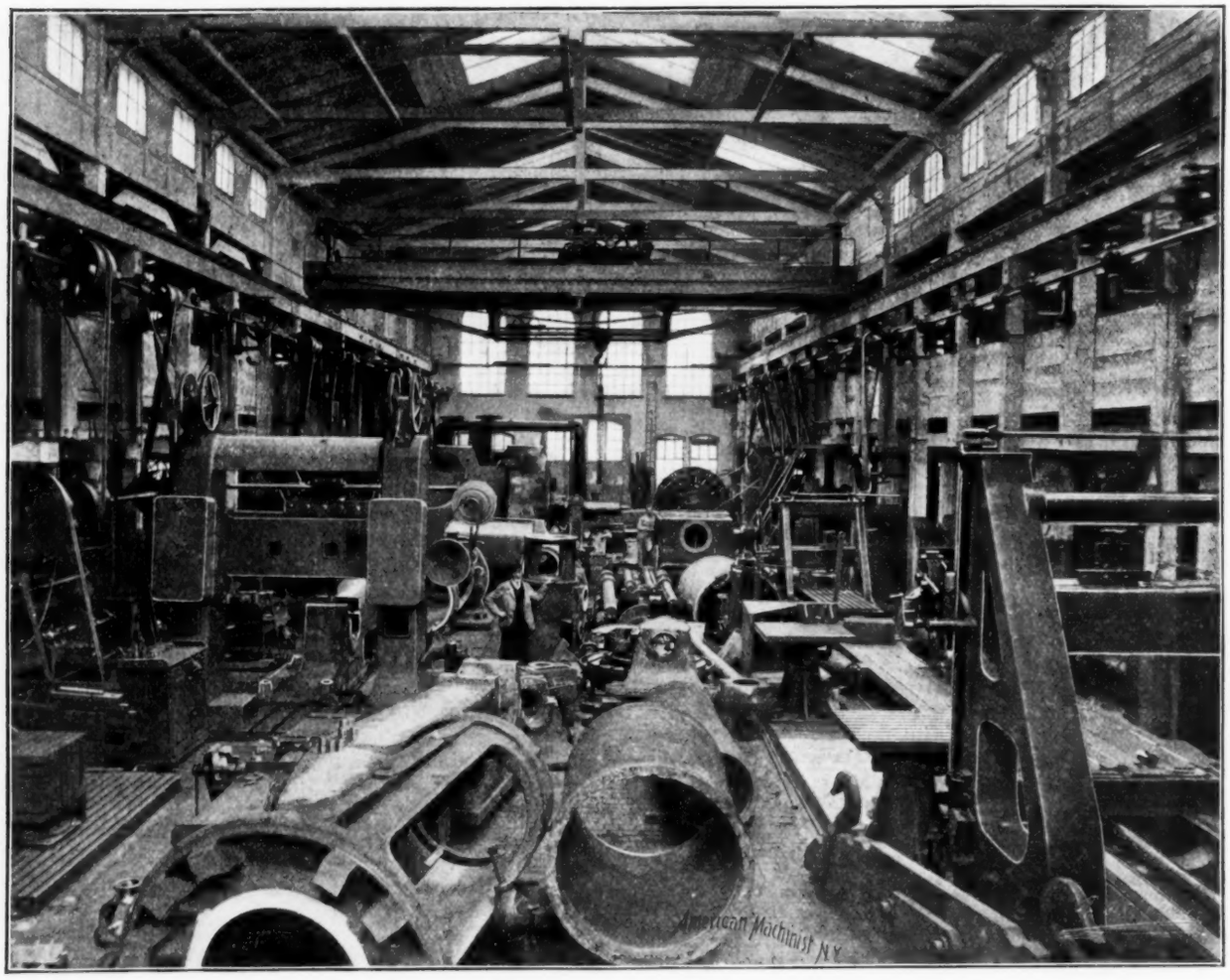

FIG. 5.—SULZER MACHINE SHOP.

used are headless and are tightened by a screwdriver. The side of the cutters against which these screws bear is not finished, but is left as it comes from the rolls. The cutting edges are formed and sharpened by grinding upon an emery grinder provided with a special fixture adapted to hold the cutters by the same ground surfaces, and all such grinding for the entire establishment is done in one room set apart for this and similar work, and which room at the time I saw it was not pervaded with dust nor with a mixture of emery dust and water, but was the neatest and cleanest place of the kind I have ever seen.

Steamboats, such as ply the Swiss lakes, are built here under rather peculiar conditions. Our American lakes are all connected with each other, so that a shipbuilding plant placed upon any one of them may build and launch at its works a vessel which may subsequently steam to any port in any of the great system of lakes. It is not so with the Swiss lakes. They are not only much smaller, but are separated from each other. It thus happens that, since location upon the shores of any given lake would be of no advantage for building vessels intended for any of the others, the builders are about as well off away from any lake, and these steamers are built at the Sulzer works and completely erected, using bolts instead of rivets. When complete the bolts are taken out, the vessel dismembered, transported to the shore of the lake where it is to be used, riveted together upon launching ways and slid into the water. These vessels are, I think, all side-wheel steamers, and are driven by inclined, direct-acting, compound engines. They are for the most part elegant and fast steamers, and trips taken upon them are apt to be remembered as among the pleasantest experiences of European traveling, heightened, perhaps, by the contrast with the miseries of traveling by rail.

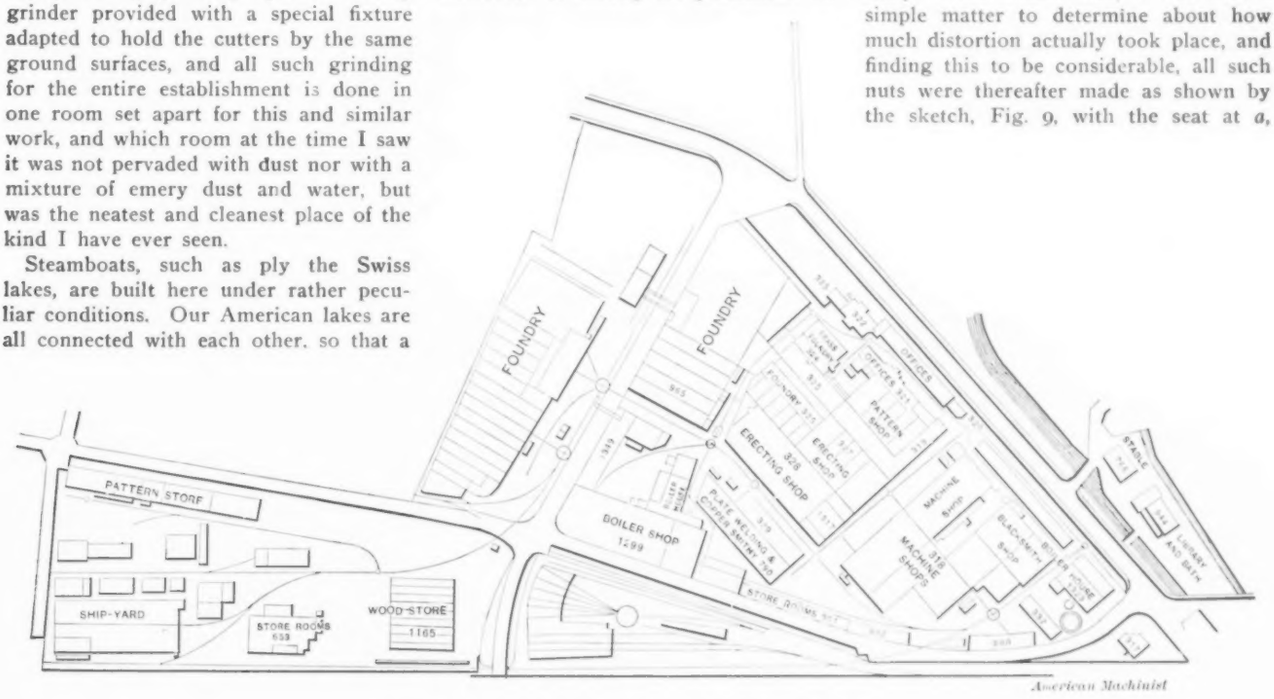

FIG. 6.—GROUND PLAN OF THE SULZER WORKS.

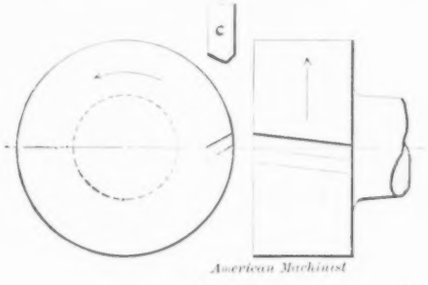

Fig. 7

MILLING CUTTER HEAD.

I noticed that the more important screws about the engines built here had threads of the shape shown in the sketch Fig. 8, and was informed by Mr. Sulzer that this form had been adopted because tests had shown it to be the strongest practicable form, the tensile strength of the rod being considered. The refinement to which things are carried in this shop is shown also by their practice in regard to the more important nuts, such as those used in the ends of the connecting rods of the marine type. It seems to have been first reasoned that, since all metals yield more or less to applied stresses, it must follow that when a nut is tightened it must be more or less compressed, and by the same force the bolt is at the same time stretched. This being the case the pitch of nut and bolt are changed in opposite directions, and no longer correspond. This led to the conclusion that only the first few threads at the bottom of a nut could receive any considerable portion of the load, and some experiments made with nuts composed with soft alloys confirmed the theory. Knowing the modulus of elasticity of the metals used, it was then a simple matter to determine about how much distortion actually took place, and finding this to be considerable, all such nuts were thereafter made as shown by the sketch, Fig. 9, with the seat at *a*, half way between the bottom and top of the nut. Thus the lower half of the nut is in tension and the upper half in compression, and the error is reduced to a negligible quantity.

Fig. 8

A FORM OF SCREW THREAD.

Considerations of space and limitations of time prevent the mention of all the interesting things which I saw in this establishment, but it is evident from what has been said that its splendid reputation rests upon a substantial foundation. I feel quite certain that no American engine or tool builder could go through this establishment, as it was my privilege to go through it, without learning things of great value to him, and I am equally certain that the Swiss people can teach us a lesson in the science of government by and for the people, which, if we would only learn it, might save us a great deal of trouble.

F. J. M.

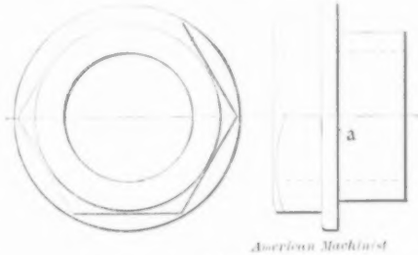

Fig. 9

NUT USED AT SULZER'S.

American Machinery in Germany.

Charles L. Cole, our Consul-General at Dresden, has been investigating the American business in machinery there, and reports as follows:

PACKING.

Heavy machines have been received loosely or insecurely packed in fragile cases, allowing them to move and punch holes in the boxes. It often happens that parts of machinery easily broken or bent protrude from the sides or ends of cases, and these are almost invariably damaged in transit. Polished parts of machinery should be thoroughly "doped" to prevent rust that will occur during a long ocean voyage unless properly protected. Machinery is sometimes packed in cases so tightly put together with nails as to cause trouble and expense in opening at the custom houses, and frequently the boxes are entirely destroyed in the operation. While good and secure packing is desirable there is a happy medium.

CARELESS INSPECTION.

Imperfect machines are sometimes received, requiring a portion or the whole replaced. This entails a delay of one to three months, and is most provoking to a man who needs the use of the machine and has purchased in good faith.

INVOICES, BILLS OF LADING, INSTRUCTIONS, CIRCULARS.

Sometimes shipments from America reach here before the invoices and bills of lading, without which the purchaser is unable to obtain the property. There is no excuse for this. Full instructions for setting up and operating machinery should always be sent. What may seem very simple to an inventor or manufacturer is often puzzling to a person not familiar with a machine or its operation.

It is simply a waste of time and money to send circulars printed in English. A circular should be plain and attractive, and, unless printed in German, will receive no attention in this district.

GENERAL REMARKS.

Net and shipping weights should be quoted. Prices at some inland city are often quoted, instead of the price free on board at New York or other port. A purchaser can usually determine the transportation cost from an American seaport to destination, but he has no means of learning the cost of railroad transportation, and, when local rates are exacted it adds materially to the cost of the property at destination. The charge for boxing is often quoted "at cost" instead of stating the amount. Manufacturers intending to "work" this market should, I think, employ means of ascertaining the integrity and financial ability of parties with whom they deal. Demanding cash on order bills of lading from Government railways or arsenals, and from established firms of undoubted standing, is provoking and is calculated to make these parties look elsewhere for supplies. Some agents complain that manufacturers fail to patent their machines, and, after a demand for them has been built up, they find the article is being manufactured here. Too much care cannot be exercised in this direction. Some American manufacturers reply to inquiries for prices by stating, "We are represented in your district," without saying where their agents can be found. Care should be taken to plainly address all letters and circulars sent by mail. Employés of the postal service cannot usually read English, and at best are working under difficulties that should be made as easy as possible. Letters and circulars should have the postage fully paid by attaching the necessary stamps. When the postage is but partially paid, letters are subject to delay in delivery, and, besides, when writing on your own business it is scarcely bid fair to subject the recipient to this tax.

CHARLES L. COLE, Consul-General.
Dresden.

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A Patent of Ancient Date.

Several towns in Connecticut have claimed each that the first person in this country to receive a patent had lived in that town. It is doubtful if anyone can claim an older date than the following: Otis A. Smith, manufacturer of firearms at Rockfall, is in direct line of descent from Joseph Jincks, of Lynn, Mass., the first recorded inventor in America. In 1655 he was granted a patent for an improved scythe. He also made the first casting in this country, and in 1652 made the dies for the famous "Pine Tree" shillings. In 1654 Mr. Jincks made for the City of Boston the first fire engine in America, and his name is also associated with other inventions of that time.—Hartford (Conn.) "Courant."

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An Example of Jig Making.

BY A. H. CLEAVES.

The jig here described was designed by Mr. Fred Smith, manager of the Chicago Manufacturing Optical Company, and combines so many good points that I think it worthy of notice as a good example of jig construction.

Figs. 1, 2 and 3 show the front elevation, end elevation and plan respectively of the piece to be drilled, faced, etc. There are four holes *A*, shown in Figs. 1 and 2, for rods to enter. Two projections or bosses *B*, having holes *C* to be tapped, countersinks *D*, and faced surfaces at *E*. The two hubs *F* are also machined off, faced off at *H* and drilled at *G* for tapping for screws. Four screw holes *I*, Fig. 3, are for fastening the fixture to the bench.

Fig. 4 is the plan and Fig. 5 one elevation of the jig. In Fig. 5 *J* is the casting to be drilled, etc., shown fastened in place in the jig.

At this place mention might be made of a very helpful practice in making the working drawings for jigs, viz.: that of drawing the piece to be drilled or worked like *J* in red ink, the contrast with the black lines for the jig itself making the whole very clear to the workman.

The casting *J* rests upon two bosses like *K*, and also at *L* on the jig. *M* is an

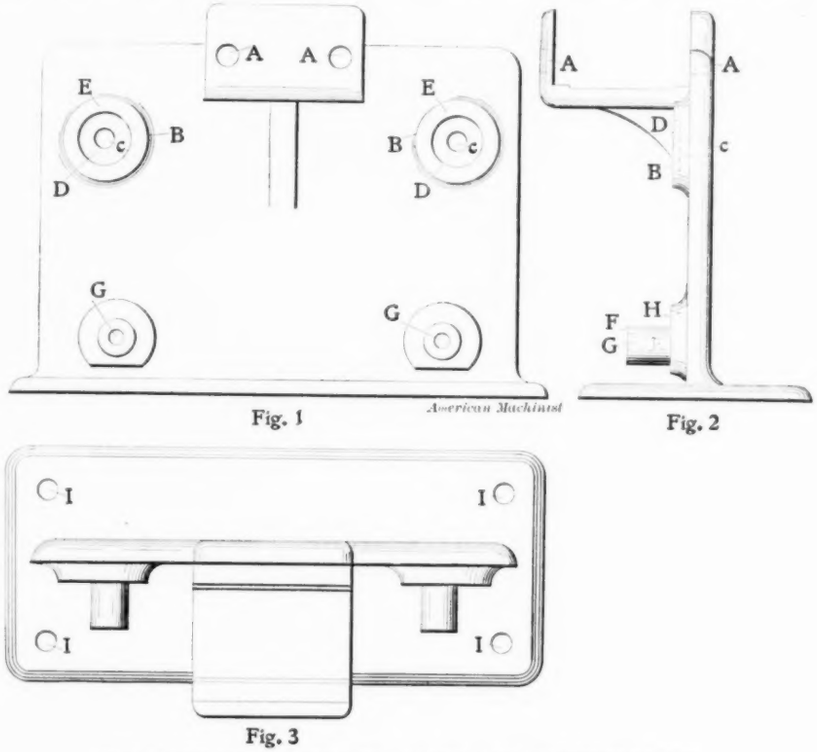

Fig. 1 Fig. 2

Fig. 3

THE WORK TO BE DRILLED, FACED AND COUNTERBORED.

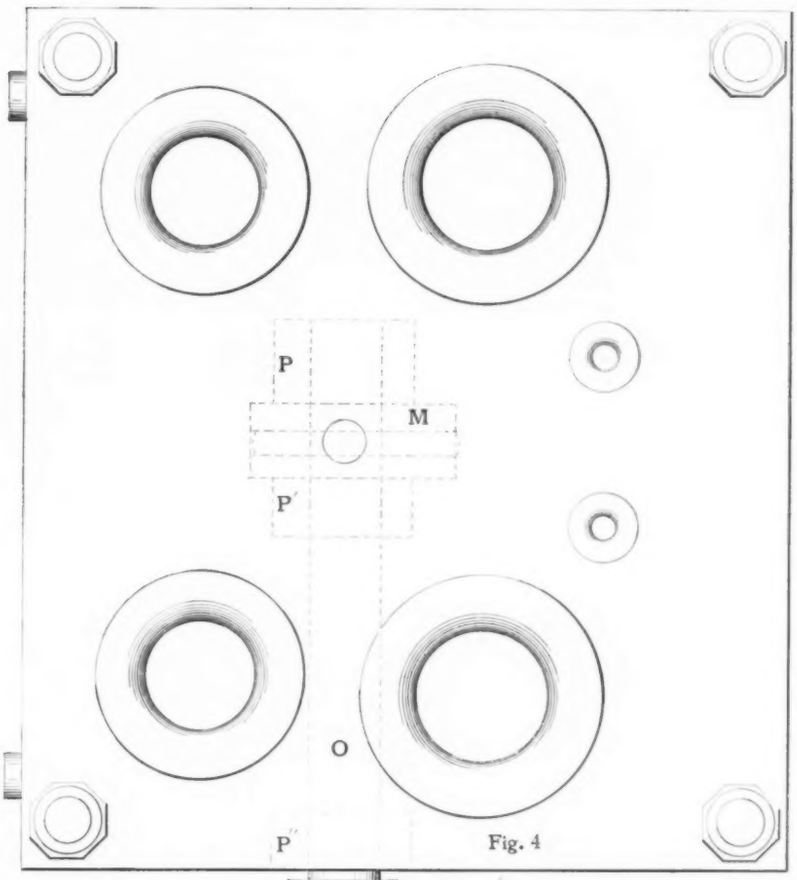

Fig. 4

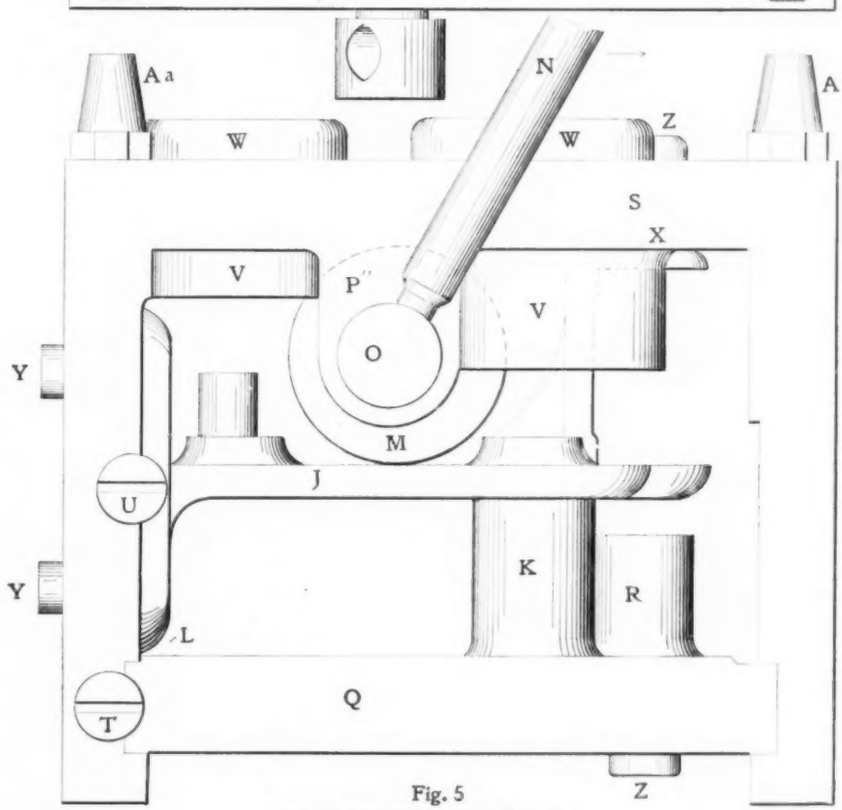

Fig. 5

JIG WITH WORK IN PLACE.

eccentric or cam carried on the shaft *O* for locking the work and jig at the same time. The handle *N* moves in the direction of the arrow to tighten the cam, which throws the work *J* up to the side of the jig. The bearings of the shaft *O* are cast on the jig, and are seen at *P*, *P'*, *P''*.

The plate *Q*, with the bosses *K* and *R* cast on it, slides in the main casting *S*, coming to the stop-screw *T*, the other screw *U* being a stop for *J*. Tightening *J* with *M* also locks *Q*. Projections *V* are cast on *S* for the large bushings *W*, and a sink is also cast in *S* for the casting *J* at *X*. The bushings at *Y* are for the four holes *I*, Fig. 3, those at *Z* being for the holes *A*, Fig. 1. The studs or feet *Aa* lift the bushings *W* and *Z* from the bed of drill press.

Where the drills used, as in *Y* and *Z*, correspond to the size of holes in the

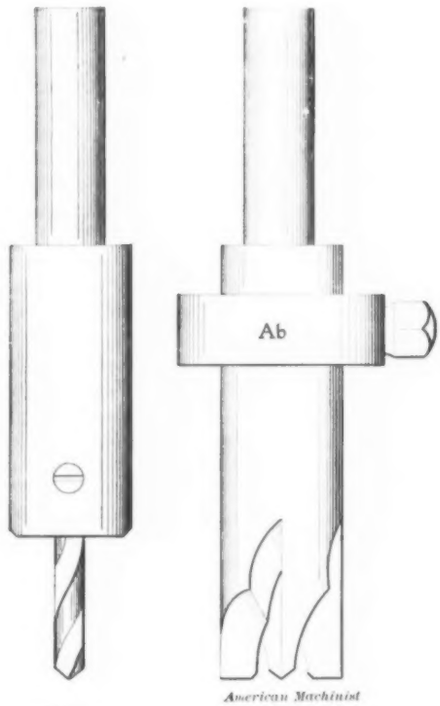

Fig. 6 **Fig. 7**

SOME OF THE TOOLS USED.

bushings the jig should have the drill number or size stamped on it near the bushings.

Fig. 6 illustrates the method of drilling the holes *C* and *G* where the same bushings *W* are to be used for the hollow mill, Fig. 7, as well. Incidentally, these drills in a heavy jig are more readily entered than those in *Z* and *Y*, as the rigid chuck pulls the jig into place easily.

Fig. 7 shows a hollow mill for cutting down the hubs *F*, Fig. 2, and facing off *H*, a similar tool being used at *D* and *B* —or rather the same method with a different style of tool, a collar *Ab* giving the required depths.

In this jig the plate *Q* is released and

removed very quickly, leaving everything open for *J* to enter easily, when all the operations can be done at one holding.

It will be seen that this jig, with the use of studs like *Aa*, will admit of bushing and using on six sides in some cases, provision (not made here) being allowed for the bushings.

Chicago, Ill.

▲ ▲ ▲

Light Railways in England.—Why England Has No Trolley Roads.—The London Underground Roads.

BY W. H. BOOTH.

A light railway in England is a species of line which is supposed to be all that a locality of small traffic can afford, and in many respects it falls short of the requirements of an ordinary railway. For example, an ordinary railway is everywhere fenced, excepting footpaths; all crossings at grade have gates and an attendant, and the signals and other expensive adjuncts. A light railway is different. It is frequently laid along the cess and only leaves the road to make occasional short cuts over a field or two. It is not fenced in and has no signals, except of the smallest order. The cess I must explain. It is a local term, confined, so far as I know, to the fen districts of England. In Lincolnshire and very generally in East Anglia, as well as over other parts of the country to a less extent, there is a wide strip of land along the roads between the road surface itself and the hedge or ditch which fences in the adjoining fields. The original idea of the cess was, I believe, to afford grass for driven flocks of sheep or oxen in traveling from place to place or to market. This cess now forms a convenient strip of land along which to lay a railway of the so-called light order. By statute a light railway is not a tramway; actually it is; but there are different methods of procedure to obtain sanction to lay a railway, a tramway or a light railway, and the latter is the easiest of the lot; so that even large railway companies wishing to extend or build a branch line are said to apply for permission to lay a light railway rather than to incur the trouble and expense of going to Parliament for the usual "powers." There has been a mighty lot of grumbling of late years over a lot of things, and among others over transportation facilities. Many who grumble don't think first. They hear about America and electric lines and ask why are there not more here? They entirely overlook facts. One fact is that up to sixty years ago the country did very well without railroads; but in doing without them, because they had not been invented, the system of transportation by canals had grown up to be something very big, and passengers had very excellent coaches to travel by, and in pr cess of years many millions had been spent on the roads, which had been brought up to a state of great perfection, and indeed remain in that state to the present day, so as to afford considerable facility of intercommunication; so much so, indeed, that the ordinary roads are still found the cheapest means of conveying the parcels post of the Post Office Department, which has now begun to use motor vans for the purpose. The roads, however, ceased to be much used, except locally, and only appear to the general public to have been made for bicycle riders, who swarm in thousands, as many as 700 in one hour being counted passing a given point about fourteen miles out of Manchester. The roads were here before the railroads, and have never been completely ousted, so that in London, where there are no tramways within a certain inside area, the whole road surface is smooth, and ordinary vehicles run with probably no more resistance than a tramcar on steel rails. From all this, if I could better set it down, it would appear that the necessity for further means of travel has been less urgent than in America, where roads are less frequent and there has not been time to make them. Then there are so many vested interests in an old country that it is much more difficult to get new things into practice. It thus happens that there are really no electric railways in England—none of any extent. But in London they are bound to spread, for London is so choked with traffic that one can often do better as regards time by walking than by any other means of travel. Many streets are simply filled as with a procession. Underground steam railroads have proved in a sense failures, because no serious attempts were ever made to ventilate them. There is one deeply buried electrical railway which passes under the river, at a great depth, in iron tubes. It is all right as a mechanical or electrical success, but very foul, as there is no ventilation, nor has any been attempted. Other similar lines are constructing or ready for their electrical equipment, or nearly so, and owing to the absence of this sort of work in England a considerable amount of equipment has been ordered from America. These buried railroads consist of a pair of large cast iron tubes, laid side by side, and about 16 feet diameter is the largest projected. There is at present constructing under the very center of the city a large underground station, from which, I believe, three of the double tubes will radiate, and soon probably a fourth or more. In the construction of these tunnels London possesses what probably no other city of such magnitude does possess, namely, a particularly suitable subsoil. London stands upon clay, which is in great part covered, to a depth of 20 to 30 feet, with sands and gravel, more or less charged with water. Below the gravel is the clay, which extends to a depth of 100 to 200 feet, and outside the mass of the city even deeper. It is in this clay, which is practically waterproof, that the tubular tunnels are bored. The operation is simplicity itself, and devoid of serious risk in the firm and dry clay, but careful alignment is necessary. The stations are placed at convenient intervals along the line of route, occupying the site of some hitherto existing building, the station sites being at present simply the site of the large shafts up which the excavated material is raised. The tunnel segments of cas iron, like large well tubings, are buried and will finally form the elevator shafts, the tunnels being too deep for passengers to use without elevators. But because there will be no steam locomotive to run in the tunnels is no reason for neglecting the question of ventilation. A deeply buried tunnel has no self-ventilation. As the two tubes run between the same stations, the stations being enlarged excavations taking the ends of both tubes, the pushing action of the trains in the tubes simply serves to circulate air from station to station of one tube and back again by the other one. Very little is forced to the surface, and the air becomes very impure, so that it is a distinctly unpleasant experience to travel by the existing line, and without provision for positive ventilation such deeply buried lines will be used by many fewer people than otherwise would be the case. When traveling by an underground steam railroad passengers know that they are breathing a sulphurous atmosphere which must be very inimical to disease germs. In electrically worked tunnels there is nothing to destroy the germs and ventilation is necessary.

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Fire at Kansas University.

On the morning of the 22d ult. at 5 o'clock A. M., in an electrical storm which occurred at Lawrence, Kan., the power house and machine shops of the State University, located there, were totally destroyed by fire. The cause ascribed is lightning, which appears to have struck the high smokestack and from there conveyed to the roof of the buildings. Everything contained in the buildings were completely destroyed with the exception of the four boilers, which were more or less injured. The power plant consisted of two engines and seven dynamos, of various types and sizes. The machine shops contained seven lathes, one milling machine, one planer, two drill presses, one jumper and various other small machinery for the better equipment of a shop of this character. Total loss is estimated at $50,000.

Letters from Practical Men.

Two Good Counterbores.

Editor American Machinist:

At the risk of overdoing the counterbore business I send a description of a style that I have seen used quite largely in some places and not at all in others. The twist drill has been a great educator in the matter of cutting edges, and I believe it is responsible for much of the improvement in that direction in recent years. The old flat drill has not been entirely crowded out, but it's a poor second. I remember very well when machinists used to say: "Oh, yes; twist drills are all right for cast iron, but they ain't much good on steel." Well, a flat drill certainly will cut in harder metal than a twist drill, unless you virtually make the twist drill into a flat drill by grinding; but for the average drilling the twist drill leaves little to be desired.

An instance of the preference machinists soon learned to exhibit for twist drills happened some years ago in a shop in which I was working. A lot of flat chucking drills were got out, planed, centered, turned, hardened and ground, and placed in racks ready for use; but the dust soon began to accumulate on them, and they were used so little they never needed grinding. The boys all used twist drills for everything they could find the size for, and I think in the majority of cases they were right. Now in a counterbore it seems to me the nearer we can approach the cutting angles of a twist drill the nearer we are to being right. Some of the recent counterbores shown are made in this way.

The two counterbores which I will describe have done good service in many shops, the cutters are simple and easily made, and I know of no form for which a cutter can be made any quicker. The style at the left in the sketch is, or rather can be, a simple rough bar, the ends centered and squared up, a hole drilled through it, and the cutter a plain round piece of drill rod, pinned in, faced up in the lathe, relieved with a file, hardened and touched up on an emery wheel. It is then ready for use. The stock at the end beyond the cutter is turned to the size of the hole already in the work. This form is weak, as will be seen. and it cannot be jammed carelessly into the work; but, with ordinary care, it will roll out chips like a lathe tool, and cut so easy that it is a pleasure to use it. I have enlarged holes from 1 inch to 2 inches and 3 inches with a tool of this style, from 12 inches to 24 inches long. It is a good tool to make for any odd size or for a size that you do not happen to have any drill or counterbore for. It can be made quickly and cheaply, and although the cutters may break occasionally, they are so easily made it causes little delay. I have used them in the lathe and drill press and always found them to work well.

The form shown at the right is much stiffer, and a number of cutters, varying in size, can be used with one blank. The blank that supports the cutter should fit upon the cutter top the entire length. They can be cheaply made in the shaper by planing up a strip 10 or 12 inches long and throwing the head over and planing the notch in one edge with a square-nose tool, then cutting up into lengths convenient to use.

MACHINIST.

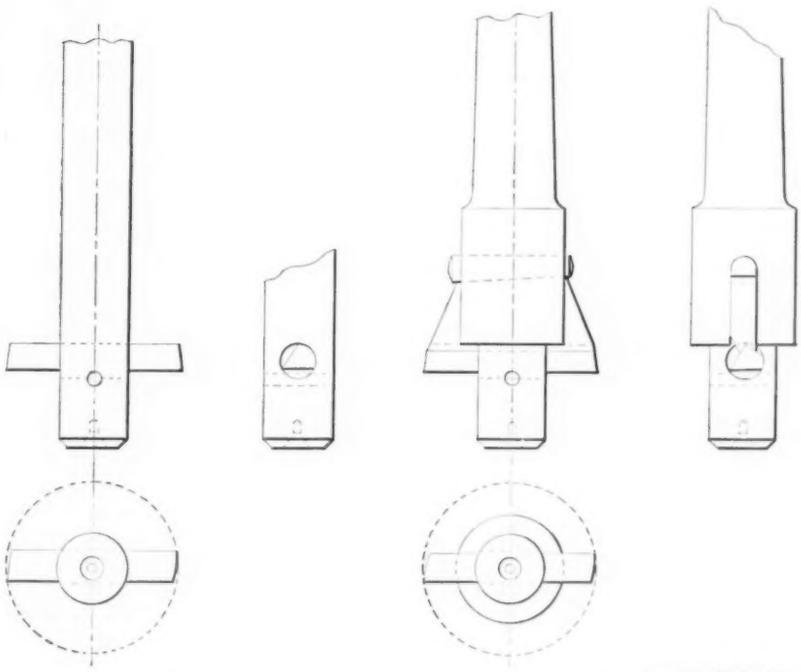

Fig. 1 Fig. 2

TWO COUNTERBORES.

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American Machine Tools in England.

Editor American Machinist:

On opening my copy of your issue of March 3 I was surprised to find a sharp English criticism of an article of mine which appeared in "Engineering" so long ago as December 3, and which was reprinted by you a month later. But for the fact that I am, as I long have been, a reader of the "American Machinist" the criticism would have been unobserved, and I should have had no chance to reply.

Mr. Austin says that "this continual prating about the ignorant conservatism of the Englishman and the wonderful adaptability of the American is enough to make a man sick." Now, prating signifies senseless loquacity, tautology, reiteration. But the article which so aroused his ire was a statement of hard facts, very hard facts, which no amount of abusive speech or ironical banter will get rid of. I will restate some of these facts:

That the machinery exhibited in the London shows for employment in the manufacture of cycles is almost wholly of American make. That such machinery is not only used in the English cycle works, but also in many general engineers' shops. That it is, as a rule, more handy, expeditious, automatic than English machinery. That its sale is increasing. That the number of agents for its sale and for that of American machines in general has increased. That with the exception of a few English firms, and these being chiefly among the younger and rising ones, little or no attempt is made to produce machinery of the class which is being imported from America to England. That among the younger firms the best machines are generally those which are either copied in every, or nearly every, detail from American models, or which imitate the latter in some details. That a very large proportion of fine tools, drills, micrometers, reamers and taps, squares and calipers, gages and measuring instruments of many kinds come to us from America, but do not travel the other way. One might instance a good

many more facts, but these afford a sufficient justification for the article for the writing of which I am attacked. These and kindred cases are convincing proofs of the English conservatism in practice and of the alertness of the American. It is not so much a question of purchase, as Mr. Austin suggests, because many of those who buy these tools are not toolmakers. There are exceptions, of course, such as Messrs. A. Herbert, of Coventry, who make tools of American type by the aid of American machines. The real conservatism consists in the absence of that spirit of rivalry and invention which is essential to success in business. American firms have agents over here, keep machines in stock here, advertise in our "Engineering," are constantly endeavoring to eclipse past successes. Can the same be said generally of the English firms?

In reference to Mr. Austin's criticism that it is not an unmixed blessing for a firm to be engaged in one line only, that might well open up a wide discussion, and a good deal could be said on both sides. As regards the question at issue, I simply stated a fact when I remarked that the American shops are becoming more specialized than the English ones, and saw in that one reason for the high development reached by their special tools. To that statement of course there are exceptions. But the names of the firms which I instanced bear out my contention that the highest success lies in specialization. The latter may have a narrowing effect on narrow intellects, but when grafted on original, broad ideas and on previous sound general practice it realizes the best success, and commands the greatest confidence.

In reference to the automatics, I am sure no practical engineer would take the crude view which Mr. Austin attributes to a "section of the trade;" certainly it was not a legitimate deduction from my article. Automatic turrets have the advantage over hand operated ones, in that they eliminate the human element, and are not so liable to rough usage, and therefore they are more rapid of action and more economical in the long run.

The remarks anent the scarcity of English tools at the Stanley show Mr. Austin considers "unfair," because several makers "had a strike on, which had been in operation several months." I considered that point in the article in question. There was no strike on in the previous year, yet then, as in 1897, the exhibits of the American agents largely exceeded those of English firms. At neither show have the older firms of English tool-makers had any exhibit, neither in 1897 nor in the previous year, when there was no strike on. Besides, the Birmingham district was untouched by the late strike.

My statement respecting screws at threepence per hundred is correct. The limit is about 1-1000 inch. They have to fit the gages exactly without slop. Of course the British Government doesn't make screws in competition with private firms.

The suggestion provoked by my remark that, "In all these machines the bearings are so massive that any sensible wear is practically impossible must surely have been copied from some catalog," is not argument. I wrote of what I *saw*. I could have said the same of certain English lathes had they been there. The bearings and other parts which are "extra large," "extra strong," "extra long," figure much too largely in English catalogs, and mislead no one who knows. In American catalogs actual dimensions are frequently given. And Mr. Austin must be badly served with machine tools if he is not able to get bearings that "don't wear"—using the term in its practical sense.

In reference to Birmingham producing the best small machine tools made in England, and the use of the scraper certainly they are very good, and the writer has not infrequently instanced these tools. But *the best* is drawing a long bow. For there is also such a place as Manchester, where small as well as heavy machines are made. It is a pity that the good Birmingham firms have not done something, as they might have done, to prevent the influx of American machines into their district. Only last July I heard the mayor of Wolverhampton state before a gathering of the Institution of Mechanical Engineers that a shop in that town in which he had an interest was equipped wholly with American tools. Not because he had any partiality to foreign machines, but because he could not get English ones to do the work he required. I noted also in the nearly new Daimler motor manufactory in Coventry a large number of American lathes and machine tools. And this right in the Birmingham district!

In reference to the next charge, I did not say or imply, as Mr. Austin suggests, "that the workmanship in the best American tools is better than that on the best English ditto." But it is as good, and that is saying a great deal.

As to the bolting on of brackets for lead screws, this has long been good English practice. Though a good many firms adopt the plan of casting on; given planed and tongued surfaces, broached holes and turned bolts, the brackets are as firm as a rock. Casting on saves planing and drilling.

In reference to that lead screw, I can only say that Mr. Austin seems rather unfortunate in some of his experiences with American tools. Yet he uses them nevertheless. He does not give the names of the makers of the tools of which he complains in this and in a previous letter of some good while since. There are bad tools in America, as in England, and for that reason firms will often pay just about twice as much for a machine to one firm as they would have to give to another.

In conclusion I assure Mr. Austin that I haven't the slightest pecuniary interest in the sale of American tools. I hold no agency for them. The subject is simply one which has a fascination for me, the development of which I, with many others, note with interest.

JOSEPH HORNER.

Bath, England.

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Measuring Tapers.

Editor American Machinist:

A citizen of Greater New York strayed out into the country the other day, it was before the hens got their spring hustle on, and he got into quite a quarrel with a farmer over the state of the egg market. He remarked that eggs were going down, while the countryman maintained that they were going up. They both got very much excited over it, and yet it happened that both were quite right all the while. The citizen was talking on the basis of so many eggs for a quarter, which is the New York style of retailing them, while the countryman was talking about the price per dozen.

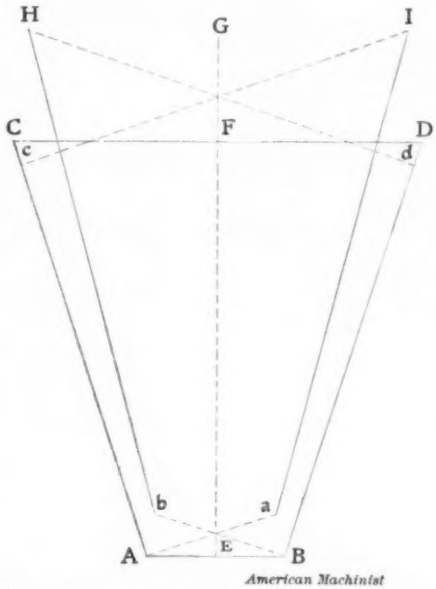
I suppose it is about the easiest thing in the world to find something to quarrel about, if anybody is inclined that way, and it is just as easy to find what will pass for arguments in support of any position. We all know very well, for instance, what the word taper means, and we all know just as well what is meant by a taper of so much to the foot. I could not very well suggest anything clearer than that. Well, after all, it is not as clear as it might be, and there is certainly a chance for some dispute about it, and, what is more, I have known quite recently of some misunderstanding on this very point, and that is what makes me think it is worth while to speak of it.

Say that we have a taper plate *A C D B*, with the ends *A B* and *C D* each perpendicular to the center line *E F*, the length of *E F* being 1 foot, and the lengths of *A B* and *C D* being, respectively, 4 inches and 12 inches, then the taper of the plate is 8 inches to the foot. If now we measure off a foot on *A C*, giving us *A c*, and erect perpendiculars *A a* and *c I*, *A a* being 4 inches and *c I* being 12 inches, then the taper defined by the lines *A c* and *a I* is also 8 inches to the foot; but as *a I* is not parallel to *B D* we see that we have two different tapers, each of which it would be correct to call 8 inches to the foot, and, for anything that I know to the contrary, one just as correct as the other. It is just the same, of course, if we work from the other side, taking *B d H b*, where *H b* is not parallel to *C A*, and the angles, of course, show the same dif-

ference as we found on the other side.

But a still worse case comes when we get to conical work. Is the taper, by the foot, of a piece that is turned in a lathe to be measured with the axis of the piece or with one side of the piece as the key to the measurement? The difference, according as one or the other method was adopted, would be of the same kind shown in the figure. But suppose we have a taper attachment on a lathe, shall the taper to which it is set be measured with the straight line of the lathe ways as a base or shall the central line of the angle be what we measured from? Then shall we call the angle of the work produced the same as that to which we set the taper attachment or double that? If we are buying a lathe to turn a taper of, say, 2½ inches to the foot, must the taper attachment set over to that taper or only to one-half of it?

These questions I know to have all actually arisen. Either view is likely to seem absurd to the other party, and yet there is probably something to be said for each. I am inclined to think that for planer work, the angles of wedges and



DIFFERENT WAYS OF MEASURING TAPERS.

everything of that character, the foot lengths should be taken along one of the straight sides, and the taper should be the differences in the lengths of perpendiculars to that side. For conical work the foot length, I think, should be on the axis or a line parallel to the axis, and the differences in the diameters at the ends of the line should designate the taper.

There are a great many points on which it would be more easy to disagree than the designation of tapers, and perhaps one of the most prolific sources of disagreement would be found in lathe feeds. Who shall say what should be the standard range and variety of feeds for an engine lathe?

Well, we know how it is with standard screw threads. If there is anything that we have more nearly standardized and universally agreed upon than anything else, in the United States at least, it is probably screw threads. Now here is an example of how nicely we have agreed. Not long ago I was in what is perhaps the largest machine-screw factory in the United States. Theirs must be the kind of business that a fellow would hanker for, because it is so standardized. Well, they took me into their tool-making and tap and die-making department, and they showed me in one room about five thousand taps and dies of different sizes and threads, and yet they assured me that orders were coming in every day for screws which would correspond to none of their taps, and they were constantly adding to the variety of them.

I think it must be about the same way with lathe feeds. Many a latheman finds himself with a genuine grievance under this head, and yet the lathe builder may not be in the least to blame. The lines of work that the different lathes are employed on are so different in their conditions and requirements that it could hardly be expected that any given range of feeds would, or could, give satisfaction all around. I have done quite a variety of work in my time, but perhaps never the heaviest or roughest, and certainly not the finest work, and yet it has happened at different times that I have wanted feeds both coarser and finer than the lathe provided, and I have fed the carriage along by hand for what, added together, would cover considerable time and distance. On the same lathe I have turned jack-screws 5 inches in diameter, 4 feet long, with square thread, ¾-inch pitch, and screws for some micrometer movements a quarter of an inch diameter and 40 threads to the inch. The range of feeds provided by the lathe builders is probably as good as can be determined upon to suit the average customer, although it is quite likely that in this matter different lines of customers have led different builders to different averages. Probably there is no particular in which the lathe builder would be more completely justified in making changes to suit his customers than in the range of feeds provided, and there is also no particular in which the lathe buyer may more properly insist upon the change for his special line of work. I believe the lathe builder is perfectly right in wanting to make as few changes as possible if he wants to make money, and the lathe buyer, if he wants to make money, is just as right in looking out for the lathe that is as closely as possible adapted to his line of work.

TECUMSEH SWIFT.

A Pattern Maker's Reamer.—A Bolt Gun.

Editor American Machinist:

Herewith I send a sketch of two tools which have proved very useful in the shops where I am employed. The reamer, Fig. 1, will ream holes and give the required draft from ½-inch to ¾-inch diameter and will leave a smooth hole. I have searched catalogs for such, but never saw one until I made it. It is first turned to the right taper, bored

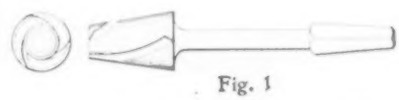


Fig. 1

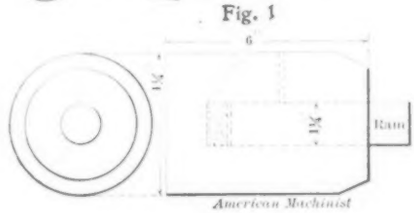


Fig. 2

A PATTERN MAKER'S REAMER AND A BOLT EXTRACTOR.

out as thin as the metal will allow and then three left-handed spiral grooves are cut as shown. So that when using it in a bit brace and turning in the usual direction it will tend to compress rather than to lift the fibers of the wood. The shavings pass through and out of the ends. I prefer to provide openings in the large end, for I found that there was a tendency to clog rather than to leave at the small end. After the cutting edges were filed the tool was backed off, so as to give about as much cut as a jack plane.

The bolt gun, Fig. 2, is made of soft steel, except the "ram," which is of tool steel and hardened. A charge of powder, about 1½ teaspoonfuls, is placed under the bolt that the workman desires to remove, "then tich her off aisy" and the business is done. It also gives the "cubs" about as much pleasure as the Fourth of July.

WILLIAM NEWTON.

Oneonta, N. Y.

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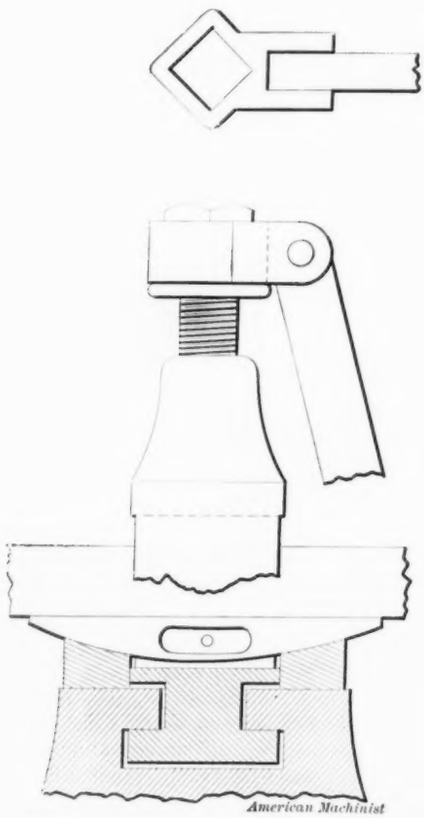
Improving the Tool Post.

Editor American Machinist:

If our friend Walter Gribbin will cut a slot in his shoe (see sketch) and put a set screw in the post he will have no further trouble with it. Also if "Machinist" will make a square head on his tool post screw, then make a short square collar to fit snugly on the screw head, and a handle with hinged joint for the wrench, the wrench will not get lost and the handle will not get in the way. Don't you think that Mr. Edward J. Kunze (March 17) makes his pieces of flat iron altogether too thin, and allows them to

rest too much below the centre line of his work. It appears to me that they would have a tendency to spring or buckle under the cut, especially if more than an inch or two wide.



IMPROVEMENTS FOR THE TOOL POST.

JAMES C. WATSON.

Montpelier, Ind.

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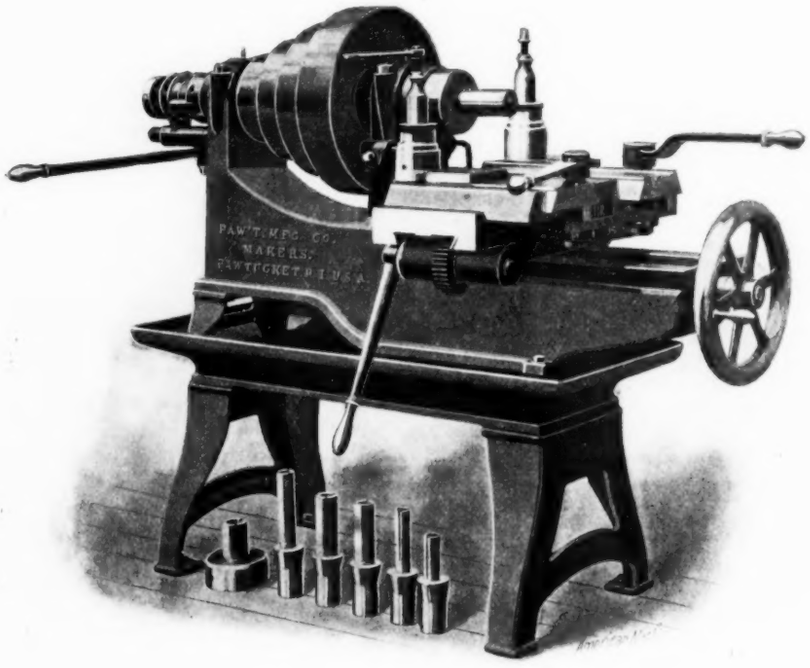
A Manufacturing Lathe.

As to the means that may properly be employed for the production of a piece of given size or shape it makes a vast difference how numerously it is to be duplicated. If a single piece is to be made, or a hundred pieces, or a hundred thousand, the process of manufacture should be very different in each case. For the latter the automatic screw machine (which makes many other things as well as screws) is doing wonders in cheapness and accuracy of work. It must have occurred to many a mechanic, as he has stood and watched one of these machines continuously dropping out its screws, studs, pins, rollers or whatever it might be employed upon, that for some purposes, as, for instance, in jobs of the 100 class, a machine of similar character, but without the automatic feature, would be of value. This idea seems to be embodied in the machine which we here illustrate, and it will be found to possess a number of interesting features.

The half-tone, Fig. 1, shows the complete machine, and calls for no special remark, except that it does not show all the appliances hereafter spoken of. Figs. 2, 3 and 4 are, respectively, side and front views and plan of the lathe, with some of the stops or gages to be spoken of later not shown. The spindle of the lathe has a four-step cone, and is intended usually to run continuously. The stock is fed in bars or rods through the hollow spindle, the split chuck being operated by the horizontal lever at the back end, Fig. 4, and a stop gage, as seen in Figs. 5 and 6, determining the length. This gage swings back out of the way, as shown by the dotted lines, Fig. 5.

The tool carrier consists, first, of a main carriage, which has a longitudinal movement by the central horizontal screw and the hand wheel at the right. Upon this there is a cross-slide operated by the hand lever in front with a rack and pinion movement, an adjustable stop in either direction being provided at the back, and the lever in front, by means of the clamping screw and quadrant, holding the slide whenever desired. Upon this cross-slide are two longitudinal slides each carrying a tool post, the post



A MANUFACTURING LATHE.

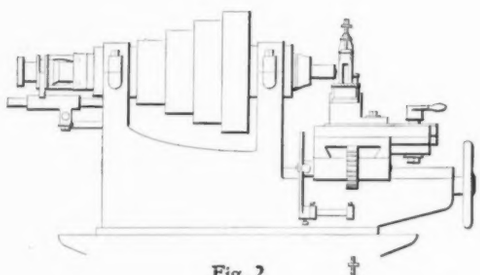


Fig. 2

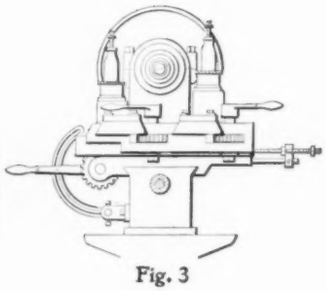


Fig. 3

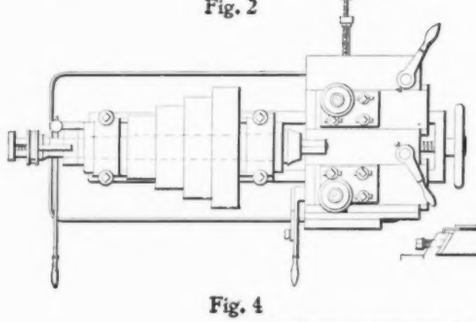


Fig. 4

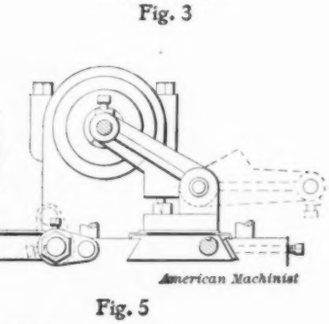


Fig. 5

A MANUFACTURING LATHE.

at the back being high enough to provide for the insertion of the tool. These slides are independently operated by the two horizontal levers on the top of the carriage, Fig. 4, and adjustable stops, Fig. 6, are also provided. In Fig. 5 one only of these stops or gages is shown, with dotted lines for its position when

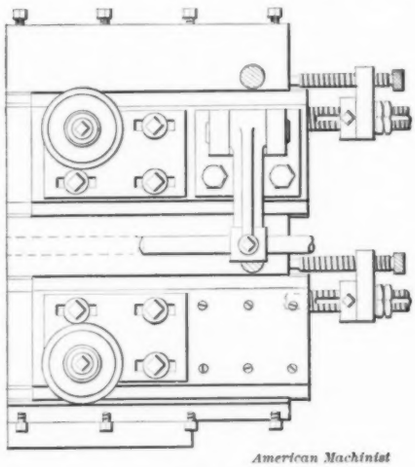


Fig. 6
PLAN SHOWING STOP GAGES.

swung up out of the way. It will be seen that this machine is entirely without automatic feeds or movements, but its adaptability to some special operations, especially when not numerous, will readily suggest itself. It is the invention of Mr. G. H. Webb, of the Pawtucket Manufacturing Company, Pawtucket, R. I.

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Mr. Tangye's Position Regarding the Engineers' Lockout.

What is known as the Birmingham district in England was not affected by the late engineers' lockout and strike, and it is significant in this connection that this district, the scene of Watt and Bolton's labors, is considered the most advanced in Great Britain in respect of the intelligence and posperity of its workmen. The Tangye establishment is located there, and this is one of those which refused to join the employers' federation in its fight against the men. Mr. Richard Tangye, in a letter published in "The Engineer," and referring to another matter, closes as follows:

"I should explain that it was well known to every member of that body [the employers' federation] that we were not in sympathy with their policy. This fact we expressly stated at an early period of the struggle, and again laid stress upon when handing over our check. It was therefore with this knowledge that the federation accepted and thanked us for the gift we had been invited to make. With their reasons for subsequently reversing their own action I am not concerned.

"In some of the paragraphs which have appeared refe ence is made to the 'probable reasons' actuating us in making our gift. It is natural to a certain class of mind to ascribe motives that are base, but my company is no more moved by these insinuations than it was affected by the threats so freely showered upon us at an early period in the struggle.

"Our course has been perfectly clear and consistent from the outset. What was it we were asked to do? Having no quarrel with our men, having received no demands from them, having had an unexampled record of forty years of peaceful relations with them, we were asked to turn them—nearly 2,500 persons—into the street. In speaking to one of the principal members of the federation I said that such an act on our part would be a crime. Its folly will be appreciated when I state that we have long possessed all the advantages the employers claim to have secured as a result of the late ruinous contest—advantages which I firmly believe they also might have possessed without conflict had their relations with their employés been the same."

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New Shop Buildings of the General Electric Company.

The General Electric Company, in view of the constantly growing demand for apparatus of its manufacture, has decided to make a large increase in its manufacturing facilities. March 25 the company placed contracts for the construction at its Schenectady Works of a new foundry which will be one of the largest in this country. The present foundry has been for some time entirely inadequate to meet the demands upon it, and considerable work has been passed on to the foundry which the company has at Lynn. The work to be done has, however, grown beyond the capacity of both the Lynn and Schenectady foundries, working overtime, and all is now to be concentrated in the new foundry, construction of which is to be begun immediately.

The building will be of brick, 500 feet long and 140 feet wide, with an "L" 100 feet by 120 feet. The latter will be used as a cleaning shop. Besides these main buildings a number of sand sheds, several smaller buildings for the storage of foundry material, and a new pattern storehouse 200 feet long, 60 feet wide and two stories high, will also be erected. All combined the floor space occupied will be about 12,000 square feet. Plans are also under consideration for a new machine shop 650 feet long by 165 feet wide, but the appropriation for this has not yet been authorized.

The buildings will be erected on the property which the General Electric Company recently purchased from the Gilbert Car Works. It lies to the west of the present works and parallel with the Erie Canal. The foundry will be built several hundred feet from the canal and will have in close proximity the sand sheds and pattern storehouse. Every precaution will be taken to eliminate risk from fire; indeed, the pattern storehouse will be made as absolutely fireproof as possible. The foundry, as laid out, will be a model of the most approved modern practice.

The contemplated machine shop will be built on Central avenue, opposite building No. 15, and will be devoted almost entirely to very large machine work. The size of the great generators which the General Electric Company has been manufacturing has of late been increasing until a generator of 4,000 horsepower is not now regarded as of unusual size. In fact, generators of 5,000 horse-power are now in course of design, and the demand upon the shop in which the large machinery has heretofore been built has far outgrown its present proportions.

The middle aisle of the new machine shop will be 65 feet wide, with narrower aisles down each side. Electric traveling cranes will be installed to operate along each aisle and a gallery will be built along one side only. All the large machine tools will be removed from their present locations to the new shop, their places being taken by smaller apparatus. The total floor space of this building will amount to not less than 144,250 square feet.

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A Model Locomotive for Purdue.

The Richmond Locomotive Works have recently presented to Purdue University a full-sized model of the front end of one of their two-cylinder compound locomotives, the intercepting valve of which is sectioned so that its operation may be seen. The cylinders are 20 and 30 inches in diameter respectively, and the saddle is surmounted by a full-sized smoke box and stack. The whole makes a very complete and impressive exhibit. Master mechanics who were at Old Point Comfort last summer will recall seeing this exhibit, and will remember the interest that its presence aroused.

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In the "Black Diamond" of recent date the report of a committee upon gasolene engines for use in mines assumes a case where a fan or pump is to be operated a mile from the power plant, and proceeds to say: "To conduct steam to this point would be out of the question, as the condensation would be so great; with compressed air the friction would be enormous; with electricity, while the loss by resistance and leakage would be comparatively small, still the motor would require constant watching." As a matter of fact the loss by friction in transmitting compressed air a mile is usually absolutely indiscoverable, and should not, in any case of reasonably adequate piping, exceed 1 or 2 per cent.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Publishing Co.,

256 Broadway, New York.

JOHN A. HILL, President and Treasurer.

C. A. HANSMANN, Sec'y.

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Subscription Price:

$3.00 a year in advance, postage prepaid in the United States, Canada and Mexico.

$4.00 a year to other countries, postage prepaid.

Entered at Post Office, New York, as second-class mail matter.

For Sale by Newsdealers, Everywhere.
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The Industrial Position of the United States.

We have several times taken occasion recently to express our conviction that the industrial position of this country is stronger to-day than at any former period of our history, and that with clear skies we are on the threshold of a great expansion of our manufacturing interests. The matter is again brought to our attention by some statistics published by the London "Statist," the leading financial and commercial authority of Great Britain.

These statistics are published under the title, "Will There Be a Pig Iron Famine?" and in connection with them the "Statist" makes a forecast of the immediate future of the pig iron industry of Great Britain. The figures show that while the production of pig iron in Great Britain during 1897 exceeded that of 1896 by 44,000 tons, the consumption expanded nearly 600,000 tons and the exports 140,000 tons, of which amount about 100,000 tons were supplied by imports from this country. Meanwhile the stocks of iron on hand at the close of 1897 were 1,064,000 tons. The outlook is for a largely increased consumption during the present year, and the question is, Where is the iron to come from? The productive capacity of Great Britain is considered by the best authorities, with which the "Statist" agrees, to have nearly reached its maximum on account of the restricted ore supply, and in any case any large immediate increase is not looked for. If England consumes and exports more iron than she makes, the excess must be imported, while if her exports decrease they must be met from some other source.

The only two countries which, in addition to Great Britain, produce pig iron in large quantities are Germany and the United States. Rapid as has been the advance in Germany in recent years, the production of that country does not yet equal her consumption, her imports from Great Britain last year having been 350,000 tons.

If these figures and expectations be true, there is but one conclusion, that England must in the near future be a large and permanent customer of the United States for pig iron, the movement in that direction during the past eighteen months not being a mere sporadic affair, but the beginning of a permanent trade which will make the United States the dominating factor in the iron markets of the world. It is interesting to compare the stationary condition of the iron industry in England with what is going on among us. Our output of pig iron last year was 9,650,000 tons, while at the present rate the output for the present year will be about 12,000,000 tons. The output of England last year was 8,610,000 tons, and of Germany 6,890,000 tons, from which the lead that we have already secured will be seen.

The "Statist" is also of the opinion that this country is at the beginning of an era of iron shipbuilding such as has never yet been seen.

It is such considerations as these, gathered partly from domestic and partly from foreign sources, which convince us of the great future of our manufacturing industries. The only cloud upon the horizon is our troubled relations with Spain, and it is to be hoped that this will not last long, whether cleared by war or by established peace.

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Some Proposed Legislation Regarding Armories.

Our statements regarding affairs at the Springfield Armory have called forth many expressions of approval and indorsement, some of them from men who have been in positions enabling them to know a good deal of what was going on there.

We have received also a communication regarding affairs at the Rock Island Armory, which goes to show that our contention for civilian management of such establishments is right.

Wages have been in dispute there, and it is claimed that army officers who have had the question to deal with have acted in a very arbitrary and in some cases unreasonable manner.

We are informed that a bill is to be introduced in Congress fixing the wages of arsenal employés, and it is expected that such legislation will prevent the trouble which arises when some new army officer is placed in charge of an arsenal and, in his blissful ignorance of manufacturing operations, thinks the simplest and easiest way to reduce expenses and make a record for himself is to reduce the wages of highly skilled men to the rates prevailing for men outside not so skilled and doing an entirely different class of work.

We hope a law will be passed fixing wages of armory employés. There is as much reason for it as for fixing the wages of letter-carriers, post-office clerks, soldiers or sailors by law, and while Congress is about it, it might, if military officers are to continue to manage armories, pass a law requiring that a model gun and a set of gages be made as a first step toward bringing out a new arm. A mechanic in charge of an armory would of course take such a step without a law compelling him to do so; but mechanics are not in charge of our armories, and if such a law had been enacted some time ago it would have greatly facilitated bringing out the Krag-Jorgensen gun at Springfield, and would have saved the Government considerable money.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(35) S., Worcester, Mass., asks the old question, "Which is the proper side of a belt to run next the pulley, the rough or the smooth side?" A.—Leather belts are made to run with the smooth side next the pulley, and it is generally considered that the best results are obtained by running them in that way.

(36) A. C. R., Cleveland, asks for a rule for the thickness of the web in gears and small fly-wheels. A.—We know of no such rule, but so far as gears are concerned should think that half the pitch plus 1-16 of an inch would give good proportions, the extra sixteenth being intended to provide for large gears of fine pitch.

(37) W. T. Dortmund, Germany, writes: "The Verein Deutscher Ingenieure" wishes to introduce in this country a standard for the taper shanks of twist drills, and as a great many of them come from America it would be very desirable to adopt the same standard which is used in your country. Will you please

state what that standard is? A.—You will find in our issue of May 14, 1896, an article fully setting forth this matter of the standard taper for twist drill shanks and the method used for measuring it. The figures given in that article are correct, and drill shanks and sockets made to conform to those figures will interchange.

(38) H. W. K., Haverhill, Mass., writes: The article on the curve of the teeth of gear wheels recently published brings up the question of this curve as applied to the sprocket wheels of bicycles. The manufacturers of a certain well-known wheel have made a talking point of epicycloidal teeth. Will you give your readers an opinion on this point? A.—We think that the curve of the teeth above the pitch line is of very little practical importance. We do not think that these curves are any better for being either epicycloidal or involute. They should be made merely so that the chain blocks may drop into place without interference, and so that they can leave the wheel also without interference, and where the block bears upon the tooth the curve of tooth and block should be the same.

(39) Constant Reader, Cleveland, Ohio, sends us some indicator cards and data, and asks why the engine does not give better results. A.—Your cards are obviously from a plain slide-valve engine and are fair for that type of engine. The back pressure is higher than it should be, but we judge this to be due to a long or a crooked exhaust pipe, as the ports and pipe are large enough. The cut-off could probably be shortened to advantage by increasing the lap; but as you do not give the travel of the valve we are unable to say how much increase of lap is practicable. No radical improvement can, however, be made. The engine will remain a slide-valve engine after all has been done that can be, which is not much.

(40) E. H., Philadelphia, writes: Using the formula

$$D - \frac{1.299}{n}$$

for the diameter of top drill, D being the outside diameter of the screw and n the number of threads to the inch, what proportion shall I use in tapping steel, wrought iron, cast iron, brass and other metals? A.—We are not aware that any effort has been made to establish any rule for this. As the threads rise more or less in tapping most of the metals, and as it is usually not advisable to tap cast iron to quite a full thread, probably if the above constant is reduced a little and is made to range from 1.1 to 1.2 the resulting threads will be satisfactory. The difference in ultimate strength in tapped holes between perfectly full threads and those which are slightly incomplete at the point is slight, and it is a common practice of the shops not to make full threads in holes tapped in cast iron.

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War.

It now seems likely that before this number of the "American Machinist" can reach its readers we shall be at war with Spain. For though there is still some hope that war can be avoided without dishonor, this now seems very nearly impossible. There can be no question but that the majority of American citizens feel that we have received sufficient provocation for declaring war and that, in fact, such a declaration is forced upon us. We can only hope that the war, if we are to have one, will be short and that the ends aimed at will be attained with the least possible loss of life, destruction of property and interference with manufacturing and commercial operations.

Machinery, as we all know, plays a very important part in modern warfare. Not only are machines actually used in battle, but machinery also does much in supplying armies with what is needed by them. Though war will stimulate the demand for certain machinery, it will undoubtedly paralyze many enterprises in which machinery is used, and indeed the prospect of war has been for months holding back undertakings which, had they been driven ahead, would have done far more for the machinery interest than any war can do. We think that those who regard war as in itself a blessing are sadly in error. On every account it should be avoided if possible, but at this writing it seems almost quite unavoidable for us. No one at all conversant with the relative resources of the two countries can for a moment doubt the final outcome of such a war.

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Foreign News Notes.

Information has been received from Seoul, Korea, to the effect that a company has been formed entirely of Koreans, having for its objects the lighting of the streets and residences of that city and the operation of its chief street railroads with electricity.

The Governor of the city is president of the company, which has been granted an exclusive franchise from the Department of Public Works, Agriculture and Commerce. The capital stock is $300,000, of which one-half is paid in.

Mr. H. Collbrau, of Denver, the contractor of the Seoul-Chemulpo Railroad, has secured the contract for the equipment of the street railroad, which will be of the electric trolley type, and of the most improved design. It will be about six miles in length, and will run from the railway station, through the south gate of the city, past the new palace and foreign quarter, through the busiest part of the city and the great east gate, to the tomb of the Empress. The contractor has received a cash payment of $100,000, and work will be pushed rapidly.

The attention of railway rolling-stock manufacturers should be called to the constantly increasing Japanese demand for bearings and wheels. In none of the present Japanese works can wheels or bearings be effectively dealt with, and it is practically certain that increasing quantities will have to be ordered from foreign countries for some time to come.

The Sultan of Morocco has resolved to re-arm his army, and has decided to raise money for that purpose at once. The first call will be for 20,000 rifles.

A. F. TENNILLE.

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The Davis & Egan Machine Tool Company, of Cincinnati, has been reorganized and its name changed to the American Tool Works Company.

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Both the Walker Company, of Cleveland, and the Bethlehem Iron Works, of Bethlehem, Pa., are reported to have taken considerable contracts for disappearing gun carriages, which are to be completed at the earliest possible moment. The contract with the Bethlehem Company includes seven 10-inch and six 12-inch carriages, besides five 10-inch guns.

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During a recent fire at the plant of the Craig-Reynolds Foundry Company, Dayton, Ohio, a number of explosions were heard. These explosions were caused by calcium carbide, which was stored in separate packages and so caused the successive explosions. This is a chemical used in supplying acetyline gas machines, and it is supposed that the fire originally started from water getting to the carbide and causing the first explosion.

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A correspondent, noticing our item regarding the exclusion of foreign students from the Prussian high schools, sends a statement from a German paper, according to which this exclusion has been only from the Berlin High School and only from the engineering department of that school, and that it has been caused by lack of room and accommodations for the number of students applying.

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Personals.

Chief Engineer J. H. Perry, U. S. N., has been detached from the "Brooklyn" and ordered to the "Minneapolis."

Passed Assistant Engineer C. B. Price, U. S. N., has been detached from Newport News and ordered to the "Vicksburg."

We welcome personal items regarding men connected with the machinery business. Kindly contribute what you can to this department.

J. W. Paul, of Stamford, Conn., has accepted the position of general superintendent of the Pittsburg Writing Machine Company, of Kittanning, Pa.

T. T. Parker, who is one of the leading boiler inspectors for the Fidelity & Casualty Company, and who usually works in the Chicago-Cincinnati district, has

been in New York recently helping to bring up the work which had fallen a little behind here.

Chief Engineer C. P. Howell, U. S. N., has been detached from the "Maine" and ordered home to await orders.

Chief Engineer J. L. Hannum, U. S. N., has been detached from the "Minneapolis" and ordered to the "Brooklyn."

Passed Assistant Engineer R. S. Griffin, U. S. N., has been detached from the "Vicksburg" and ordered to the "Mayflower."

Mr. William Marsh, formerly of Battle Creek, Mich., has taken a position as foreman with the Toledo Machine Company, Toledo, Ohio.

Mr. H. H. Carter, who returned a few months ago from a sojourn in England, has taken a position with Russell & Irwin, New Britain, Conn.

Mr. Richard Scott has resigned as foreman with the Toledo Machine Tool Company, Toledo, Ohio, to take the position of superintendent for the Olds Gasoline Engine Company, Lansing, Mich.

Mr. W. S. Accles, manager of the English branch of the Niles Tool Works in London, arrived in this country a few days ago on the "St. Louis" for a few weeks' visit on business connected with the company.

Mr. Charles Timm, founder and general superintendent of the Sterling Cycle Works for seven years and lately general superintendent of the Duquesne Manufacturing Company, of Pittsburg, Pa., has assumed entire supervision of the Illinois Sewing Machine Company, of Rockford, Ill.

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Obituary.

John B. Wilson, of the firm of John B. Wilson Company, foundrymen and machinists, Detroit, Mich., died in that city on March 15. Mr. Wilson was born on a farm on the banks of the Clyde, Scotland. He learned his trade in Great Britain, coming to the United States in 1849, and soon after settled in Detroit, where a large business grew up principally under his impulse and direction.

Percival Roberts, president of the A. & P. Roberts Company, which operates the Pencoyd Iron Works, died in Philadelphia on March 30. Mr. Roberts was of Welsh Quaker ancestry and was born in Pennsylvania in 1832. With his brother Algernon he built in 1852 a forge near Philadelphia with one fire and two hammers. In 1855 the firm turned out 314 tons of axles and bars; to-day the firm is said to be the largest bridge building concern in the country. Algernon Roberts died about twenty-five years ago, but there was no change in the firm name until the reorganization about four years ago.

Rather Warm.

In Saltpeter avenue, close to the Pit,
Where the vitriol reservoirs sputter and spit,
There's a bed on a griddle that never gets damp,
Prepared for the chap who incloses no stamp.

At the Molten Hotel in the Sulphuric Glade,
Where the temperature's nine-ninety-eight in the shade,
There's a thrice-heated chamber, dug out with a scraper,
For the fellow who writes on both sides of the paper.

Where the billows of brimstone delightfully roar
And the geysers their seething red cataracts pour,
There's a blistering bath in a cauldron of flame
For the chump who neglected to sign any name.

—Joe Lincoln, in L. A. W. Bulletin.

These things trouble not him who at his side
Has a waste basket four feet high—two wide.

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Commercial Review.

New York, Saturday Evening, April 2, 1898.

DYNAMOS AND MOTORS.

The market at the opening of this month presents a condition somewhat irregular in view of the threatened outbreak of war; yet, aside from that fact, and in spite of it, the volume of trade in the last four or five weeks has held on very satisfactorily, and we are informed by some of the companies with which we have communicated that their business has experienced no perceptible diminution from that cause. An official of one of the largest electrical concerns expressed himself in this wise: "There is no slackening in orders received for general supplies, etc., but there is noticeable a growing tendency to defer action on the larger contracts, such as power transmission plants." This is particularly apt to be the case, one may perceive, if such plants are located near the seacoast. A representative of another large company writes: "Concerning domestic orders, we believe that the war agitation has possibly delayed the placing of contracts in all classes of electrical work. The lull will be undoubtedly temporary only." From the standpoint of a third company we are informed that the war excitement has yet had no retarding effect upon business, but that there is fear that it will have in the future. A fourth seller reports March trade as showing a continued increase, and is inclined to believe that war would not effect it materially, except perhaps in respect to foreign commerce and to collections. A fifth authority speaks of a falling off in orders within a few days past, but not up to that time. A sixth has noticed it much longer.

On the other hand, the military preparations have been the cause of some special orders, though these will not, it is said, be sufficient to compensate for the loss in regular trade if war comes. We are informed that practically all the electrical manufacturing companies have been approached with the inquiry what they can furnish to the Government, and more or less war orders for electrical material have already been placed. This is a matter upon which the preservation of some reticence by the companies is natural and proper; yet we doubt not that if the recent electrical orders for Government use were known they would make interesting "copy." Some of the classes of electrical goods necessary for military purposes, and applications to be made of them, are as follows: Motors for raising and lowering guns, electric hoists, arc lamps, search lights and dynamos for generating currents to explode mines. A press dispatch from Schenectady says that seventy picked electricians from the works of the General Electric Company have been sent to lay mines in New York harbor.

We are informed that the demand for alternating current arc lamps is very active.

Among recent foreign business of the Walker Company have been orders for about forty street-car equipments and a belted generator to go to Paris and for two motors for Singapore. The company will furnish a 700 kilowatt single-phase alternator for the Buffalo and Niagara Falls Electric Light & Power Company.

ARMAMENT MANUFACTURE.

Among Government contracts placed with machinery firms have been orders for disappearing gun carriages. Of these the Pond Machine Tool Company, Plainfield, N. J., has received orders for eight, to be finished one a week, and the Walker Company, Cleveland, Ohio, is to build three. The latter are of the Crozier type, '96 model, and are to be used for 8-inch rifles.

PITTSBURG REPORT FOR MARCH.

The fear of international complications still has a somewhat depressing effect upon trade, as it is holding back new enterprises which otherwise would be commenced. The iron and steel industry is in a prosperous condition. Mills and foundries are about all in operation, and many are running to their fullest capacity. The Carnegie Steel Company, Limited, has its different works in this locality running regularly and is about completing improvements of various departments in the Homestead Works which will greatly increase the output. All the furnaces of the Pittsburg district, with the possible exception of one, are producing heavily. The output per week of

these furnaces averages about 65,000 tons, and still iron is shipped into Pittsburg from outside. The consumption is on the increase, as the foundries are melting more iron to-day than for some years past. Not only is the above true in this vicinity, but also in New Castle, Youngstown and other nearby manufacturing points. In the former place more industries are located than in any other town of its size in the country, and they are of a most prosperous kind. The largest tin factory in the world, that of the Shenango Valley Tin Plate Company, is now rapidly nearing completion. It will consist of thirty mills, and will be complete in every detail.

Machinery trade is holding up its end. Nearly all the heavy builders of machinery are actively engaged. The Totten & Hogg Iron & Steel Foundry Company and others have lately installed rolling mill equipments and have orders that will keep the works busy for a few months to come. The Case Manufacturing Company, of Columbus, Ohio, has been quite successful in placing a number of its cranes in various mills in this and other localities.

Numerous power plants are in contemplation. The Clinton Cement Company, of this city, is to reconstruct its plant, putting in new machinery, consisting of engines, boilers, etc. The Keeling Coal Company will install new mining machinery, while the water committee of Allegheny will soon receive bids for a 250 horse-power boiler. The Carnegie Natural Gas Company will install a new pumping station in Washington County and will put up a new building.

Many removals of plants are being talked about, the chief object being to be close to the cheap fuel localities. Graff & Co., of this city, talk about moving their Sharon (Pa.) plant to Monongahela City. A. Cochrane, of Leechburg, contemplates erecting a plant at New Kensington to manufacture rolls, etc. The Pomeroy (Ohio) Iron & Steel Company and Mitchell, Tranter & Co., of Covington, Ky., have in contemplation the removal of their works to other points.

CINCINNATI REPORT FOR MARCH.

For pig iron and other raw material the month of March has been quiet in this market. Sales of Southern irons have been for small quantities, with here and there an exception. An agreement made some time ago by some of the larger producers in the Birmingham territory to maintain prices on the existing basis of $7.25 for No. 2 coke iron has been adhered to quite faithfully, but in some points where strong competition prevails sales have been made as low as $7; for sellers, not parties to the agreement can, of course, take orders at whatever prices they please. During March there has been some improvement in demand for malleable castings and for wheel iron. The increased activity in car works and in pipe foundries has given an impetus to the foundry grades of iron. While Lake Superior iron is still low, some of its makers have sought to effect an advance of one or more dollars per ton for

Continued on page 40.

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Business Specials.

Gear wheels, gear cutting. Grant; see page 20.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Stationary—Rights of two valuable engine patents, both for $1,000 if taken at once; great bargain. Geo. Wolf, 215 Birch Street, Cleveland, Ohio.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Iron foundry foreman wishes position; machinery, heavy and light; first-class ref. Box 191, AM. MACH.

Buyer wants pos.; wholesale house, manufac. concern or R. R.; understands buying. Hustler, AM. MACH.

A thoroughbred machine shop foreman, and a hustler, is open for an engagement. Address Box 192, AMERICAN MACHINIST.

Wanted—Position by foundry foreman; competent experienced and reliable; an up-to-date hustler; A1 reference. Box 187 AMERICAN MACHINIST.

Tool maker of fifteen years' experience; graduate of a leading business college, seeks a position as supt. of manufac. concern; A No. 1 ref. Box 194, AM. MACH.

Young man, 31, ten years' experience as practical machinist, draftsman and designer, wants pos. as asst. supt., foreman or designer. Box 195, AM. MACHINIST.

A shop superintendent of one of the most successful turret lathe builders desires a change; nine years in present position; best ref. Box 174, AM. MACHINIST.

Wanted—Position as foundry foreman by practical foundryman; up to date in modern foundry practice, and good manager. Address Box 190 AM. MACHINIST.

A practical mechanic and draftsman, twelve years' exp., two years supt. of a general mach. shop, extensive experience in estimating cost of work, is open for engagement; best references. Box 193, AM. MACH.

Wanted—Situation as supt. or mgr. mach. works, by mech. engineer; 15 years' exp. on high speed Corliss and marine engs., pumps and general mach'y; up to date on both bus. and mech. methods. Box 179, AM. MACH.

Position as assistant superintendent or designer by tech. grad., with ten years' shop experience; can invest some money in growing concern and introduce new line of machinery. Address Box 183, care of AM. MACH.

An energetic, throughly practical foreman of tool and mfg. dept., has had a successful experience as foreman on guns, sewing mach., bicycle and typewriter, wishes to make a change with a progressive firm; ref. furnished of present and past empl. Box 157, AM. MACH.

Parties desiring the services of a factory manager are respectfully requested to correspond with the undersigned, who has had extensive experience and is familiar with modern methods of factory management; a practical mechanic, thoroughly posted on the best practice in machine shops, foundries and kindred departments, having held every position along the "line" in various lines of manufacture; salary or a percentage. Address Box 171, AMERICAN MACHINIST.

Help Wanted.

Wanted—Two practical draftsmen on engine work; steady employment to right men. Box 185, AM. MACH.

Wanted—Foreman for pattern shop; young man accustomed to engine and boiler work preferred. Box 189, AMERICAN MACHINIST.

Wanted immediately 10 first-class machinists, both floor and machine hands. Apply, The Bucyrus Company, South Milwaukee, Wisconsin.

Wanted—A capable draftsman, with some experience in designing machine tools; state salary expected and qualifications. Box 182, AMERICAN MACHINIST.

Wanted—A first-class mechanical engineer competent as designer and supt. on heavy hoisting, dredging and marine machinery. Address Box 153, AM. MACHINIST.

Wanted—A leading draftsman on heavy hoisting hydraulic and general machinery; must have at least 10 years' experience and competent to take charge of work. Address Box 152, AMERICAN MACHINIST.

Wanted—An experienced, practical printing press draftsman as leading man; give full particulars. Box 186, AMERICAN MACHINIST.

Wanted—A thoroughly competent party to manage mechanical department of modern mining and milling; technical man preferred; state age, exp., reference and salary; location good. Address Box 184, AM. MACHINIST.

Wanted—A man suitable to take charge of a factory of about sixty hands; one who has had experience in the manufacture of sewing machines, typewriters or typesetting machines preferred; location of the business is in Canada. Address, stating qualifications, salary required and references, Box 188, AM. MACH.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

Press dies made cheaply; send sample for prices. H. Dalgety, 6 Reade Street, New York.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Machinery dealers wanted as agents in New York, Boston and Philadelphia to handle our automatic engines, etc. Clark Bros., Belmont, N. Y.

Advertising Novelties Wanted—We will buy patents, manufacture for patentee or on a royalty, good advertising novelties Address P. O. Box 125, Erie, Pa.

Wanted a purchaser for a valuable patent on drilling machine, illustrated and described in the AM. MACH. May 13, 1897. Wm W. Flickinger, Cochranton, Pa.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

If you use Brass, Bronze or Composition Castings write to us for prices; satisfaction guaranteed on all orders undertaken. James J. McKenna & Bro., 424 & 426 East Twenty-third St., New York. Established 1833.

The advertising department of the American Machinist has on hand 20,000 draftsman's thumb tacks; will send a box of ten to any draftsman in America on request; could use a postage stamp on box, but will send the tacks anyway.

Mech. eng., 17 years' exp. as mach., draftsman, supt., and manager, A1 bus. and mech. ability, desires association with mod. mach. works, to build line of mach'y already introduced and on market; $30,000 of orders on hand; chance for concern with plant to secure paying bus. Address, with full particulars, Box 180, AM. MACH.

For Sale—A well established motor and dynamo mfg. business; steady trade with some of the best houses in the country; several valuable patents; special labor saving machinery designed and made for our own work; will dispose of machinery and tools, finished and unfinished dynamos, patterns, wire, etc.; building and water-power to be included or not, at option of purchaser; satisfactory reason for selling; cash price, $15,000. Address Dynamo, care of AMERICAN MACHINIST.

CAMS THE NEWARK MACHINE TOOL WORKS. NEWARK, N. J., Mill all kinds of Face and Cylinder Cams with perfect finish, no chatter marks and absolute accuracy, in any material. Cost low, for highest grade work.

THE BRADFORD BELTING CO.
CINCINNATI, OHIO, U. S. A.
"MONARCH" RIVETLESS LEATHER BELTING.
Write for Catalog "A."

Continued from page 39.

charcoal iron. Finished material generally has been in fair demand in this and adjacent territory, although structural material has been quiet.

The manufacture of machine tools and kindred lines of industry has kept up well, and some of those engaged in it are very busy with the orders they have received.

Smith & Mills inform us that they have had a good number of orders and are able to keep their force employed all the time. The business received has been largely foreign, principally from England and Germany, but also from Holland, from Stockholm and Copenhagen.

The Rahn & Mayer Company have noticed during the last few weeks an increase in this trade. The demand for their lathes is so good that they will have to increase their facilities for manufacture as soon as possible. They have a good home trade from the Southwest and have also made a shipment to Seattle, Wash.

The Cordesman Machine Company finds that trade keeps up fairly well, all things considered, although some decline has been observed, and there is a tolerably good amount of export business coming from Mexico and South America. It believes that the future offers a brightening outlook.

H. L. Shepard finds that a 15 horsepower gas engine he has recently put in comes in good play, since his shop is in a flooded district.

E. K. Morris & Co., manufacturers of special lines and general dealers in machinery and supplies, report that March business has been of a very good volume and decidedly better than a year ago.

The I. & E. Greenwald Company reports an increased demand for engine attachments, pulleys, hangers, shafting, etc., with inquiries indicating some good contracts later on.

Dietz, Schumacher & Boye have moved into their new building and are getting their machinery in shape to meet their increasing business. Since their removal R. K. Le Blond has the entire building they were in to himself, which affords room to cope with the growing sales of his tools. He finds exports particularly good, and is also receiving a share of whatever improvement there may be in this country.

The machine tool trade has not been so full of encouragment for a long time as it is now, and the indications are that the business of 1898 will be the largest in many years.

▲ ▲ ▲

Quotations.

NEW YORK, Monday, April 4.

Iron—American pig, tidewater delivery:

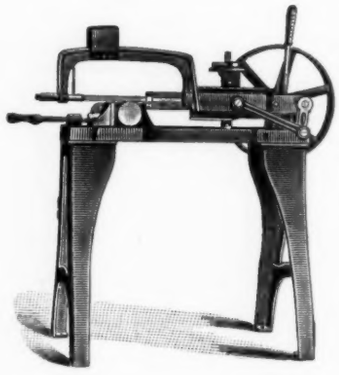
No. 1 foundry, Northern	$11 00 @ 11 50
No. 2 foundry, Northern	10 50 @ 11 00
No. 2 plain, Northern	10 00 @ 10 50
Gray forge, Northern	10 00 @ 10 50

"The best is as good as any."

The New

Automatic and Gravity Feed

Q & C Shop Saw

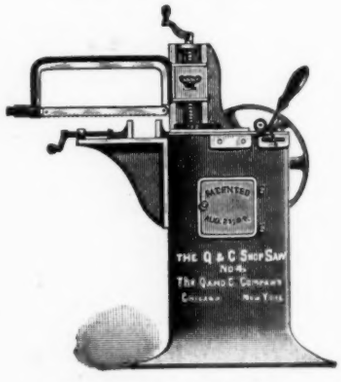


Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.
Quality—'Way Up.

Shop Saws,
Portable Rail Saws,
Cold Power Saws,

For All Purposes.



Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.

Columbia University
in the City of New York.

SCHOOL OF MINES,
SCHOOL OF CHEMISTRY,
SCHOOL OF ENGINEERING,
SCHOOL OF ARCHITECTURE,
SCHOOL OF PURE SCIENCE.

Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded, on application, to the Secretary of the University.

IMPROVED HOLLOW MILLS.

Best Made.
Lowest Prices.

Screw Machine Outfits, Box Tools, Die Holders, Etc.

ERNEST F. ROBBINS, Burrville, Conn.

U. S. Metallic Packings

are used everywhere, where the object to be gained is the successful packing of any piston against air, steam or gas.

U. S. Metallic Packing Co., Philadelphia, Pa.

Use ◆ Diamond Brand

Hardening Compound.

SAVES TIME, LABOR AND MONEY.

The Metal Specialty Co., 4 Gold St., NEW YORK

THE CROSS OIL FILTER

actually reduces oil bills 50% or more. Sent on approval. Used in 17 countries. Testimonials from leading firms in every field of industry.

Business established eight years.

THE BURT MFG. CO.
AKRON, O., U. S. A.

Largest Manufacturers of Oil Filters in the World.

FOR RENT,

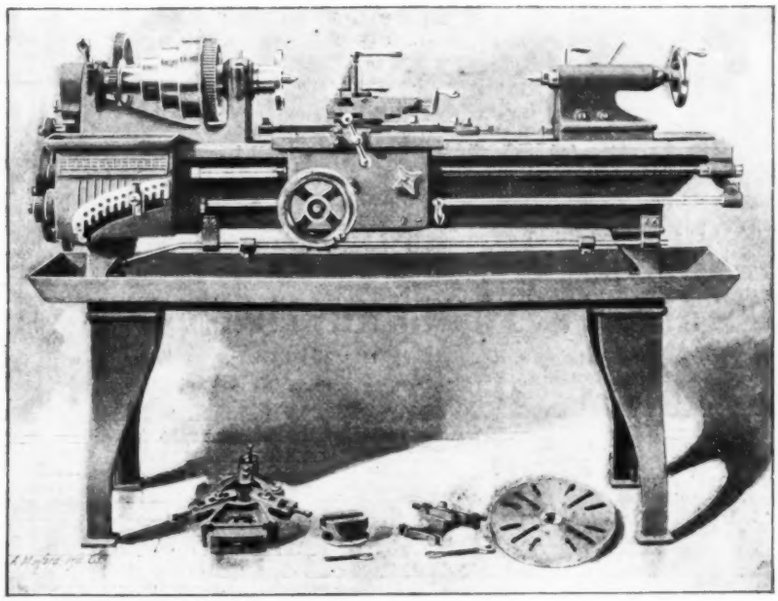
In Chicago, heavy brick building, light three sides, 37,500 feet floor, engines, boilers, shafting, elevators, etc., from May 1.

Box 169, American Machinist.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

12-in. Hendey-Norton Tool-Room Engine Lathe.



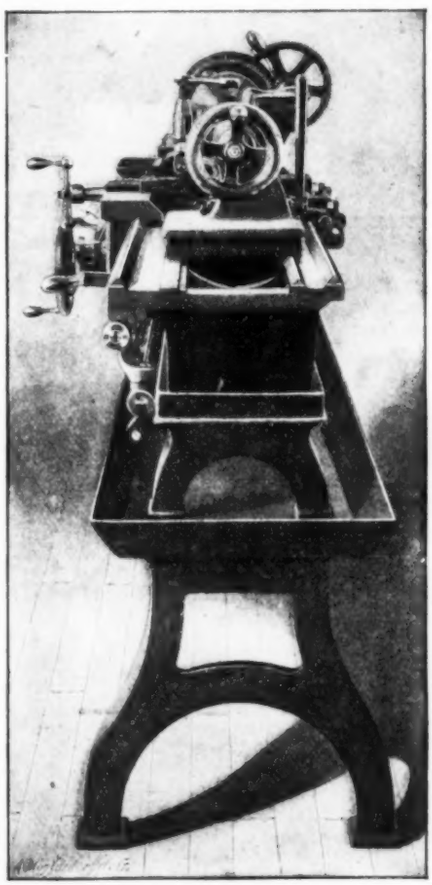
Complete in every respect as our larger sizes of lathes.

Especially designed for work in tool-rooms, experimental stations, and fine machine and repair shops. Fitted with either rise and fall or plain carriage. With or without improved taper attachment in connection with plain carriage.

This Lathe can be fitted with wire chucks in any decimal under half inch, which are invaluable for finishing small taps, reamers, special screws and studs, and other work right from the rod—no cutting off and centering of work required.

Cross-feed screw graduated to thousandths of an inch.

Beds made in 4 ft., 5 ft., and 6 ft. lengths.



END VIEW OF THE HENDEY-NORTON ENGINE LATHE.

The
Hendey Machine Co.,
TORRINGTON, CONN.

Agents for the Pacific Coast: Pacific Tool and Supply Co., San Francisco, Cal.
J. W. Cregar, Philadelphia Bourse Exhibition.

European Agents: Schuchardt & Schutte, Berlin, Vienna, Brussels, Stockholm; Chas. Churchill & Co., Ltd., London and Birmingham, England Adolphe Janssens, Paris, France.

(Quotations Continued.)

No. foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 25 @ 10 50
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, Southern	9 75 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock. Common, 1.07½ @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in retail lots, 2.15 @ 2.25c.

Copper—Carload lots: Lake Superior Ingot, 12c.; electrolytic, 11⅝ @ 11¾c.; casting copper, 11½ @ 11⅝c.

Pig Lead—Carload lots, 3.70c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 14.40 @ 14.45c., f. o. b.

Spelter—Carload lots, 4.30c., New York delivery.

Antimony—Cookson's, 8¼c.; Hallett's, 7¾c.

Lard Oil—Prime city, present make, 44 @ 46c., in wholesale lots for a good brand, with possibly slight concessions on some.

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Manufacturers.

The Elwood, Ind., radiator factory has been sold to C. M. Converse, a Chicago manufacturer, who will reincorporate, and at once enlarge it.

A malleable iron factory is one of the contemplated additions to the plant of the Missouri Car & Foundry Company, at Madison, Ill.

The brewery of A. Erdrich & Son, at Bridge and Walker streets, Frankford, Pa., is to be enlarged by the addition of two stories. Charles Auchter has the contract.

E. E. Hooker, of Rushmore, Ohio, has purchased four and one-half acres of land at Delphas, Ohio, and has commenced the erection of a planing and saw mill.

Louis Vosberg Manufacturing Company, Chicago, has been incorporated; capital, $30,000. Incorporators, Conrad H. Poppenhauser, Christopher King, Martin M. Gridley.

The Central Manufacturing Company, of Tipton, Ind., with a capital stock of $50,000, has been incorporated. The company will manufacture agricultural machinery and wagons. Directors, John P. McGeath, Oscar L. Neisler, George H. Gifford.

The Berlin Iron Bridge Company, of East Berlin, Conn., have the contract for building a new power house for the Port Jervis Electric Railway Company, Port Jervis, N. Y.. The buildings will be of a very substantial character and entirely fireproof.

The American Machinery Company, of Oakland, Cal., has been incorporated to manufacture and deal in machinery and tools of all kinds. The principal place of business is San Francisco, and the directors are Daniel Tweedle, of Alameda, and Frank Henneberg, Hubert Keon and P. P Flood, of San Francisco. The capital stock is $20,000.

A new plant for the manufacture of castings will soon be started in Greensburg, Pa., a company having recently been organized. It is composed of the following persons: Lloyd B. Huff, Richard Coulter, Jr., Esq., J. Howard Patton, Harry C. Burkett, Thos. L. Jones, J. R. Eisaman and W. W. Truxelle. The capital stock is placed at $15,000.

The proposed addition to the plant of Fairbanks, Morse & Co., at Beloit, Wis., includes some fine buildings, the largest of which will be 70x350 feet in size. To one of the gas engine shops will be added a building 85x144. To the present pattern shop will be added a fireproof addition, 102x106, the building to be 102x1156 when completed. The improvements will give employment to 200 more workmen.

The Davis & Egan Machine Tool Company, of Cincinnati, Ohio, have received a number of

orders through their office at Berlin, Germany. Among them were one from the Bayreuther Maschinen Fabrik, at Bayreuth, near Duesseldorf, for a number of upright drill presses, radial drills, 36-inch lathes, and bolt cutters. Also one from the Locomotiv Fabrik Maffei, at Munich, Germany, for a number of large engine lathes.

W. D. Wood, head of the manufacturing concern, the W. Dewees Wood Company, of Pittsburg and McKeesport, Pa., with his sons, is preparing for the organization of another company, which will erect a plant near McKeesport for the manufacture of iron and steel. The machinery will be of the latest and most improved fashion, which will do away with a great deal of labor. For the machinery alone the company expects to expend about $800,000.

The village of Ridgewood, N. J., has decided against municipal ownership of water works and in favor of some private company putting in the works, with an option on the part of the village to purchase within ten years. Individuals or private companies are invited to submit propositions to the Board of Trustees. Blanks for this purpose can be obtained from the village clerk, and all propositions must be submitted on the 25th day of May.

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New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

R. H. Brown & Co., of New Haven, Conn., have sent us catalog of wire stitching machines. The catalog is 7x10 inches.

We have received from Patterson, Gottfried & Hunter, Ltd., New York, catalog of rubber belting, hose, packing, matting, etc. The catalog is 4½x8 inches.

The Ames Iron Works, Oswego, N. Y., have sent us catalog of automatic engines made by them. Sectional views of the engines are given. The catalog is 6x9¼ inches.

We have received from the Frontier Iron Works, Detroit, Mich., circular describing the Frontier vertical gas engine. The circular is standard size, 6x9 inches.

We have received illustrated 1898 catalog and price list of forming lathes from the Meriden Machine Tool Company, Meriden, Conn. The catalog is standard size, 6x9 inches.

We have received from the De La Vergne Refrigerating Machine Company, New York, catalog of hoisting engines, oil engines, injectors, etc. The catalog is 6x9½ inches.

We have received from Baker & Co., Newark, N. J., a catalog of various kinds of manufactured platinum ware, including muffles, crucibles, stills, etc. The catalog is 4¼x8 inches.

We have received from R. E. Kidder, Worcester, Mass., catalog of drawing tables and easels. There are a number of testimonial letters included. The catalog is 4½x7¼ inches.

The Mianus Electric Company, of Mianus, Conn., has sent us catalog of the Palmer gas and gasolene engine, small propeller wheels, batteries and engine castings. The catalog is 5x7 inches.

We have received from Warren Webster & Co., Camden, N. J., pamphlet B, which is devoted to a description of the Webster system of low pressure steam heating. The pamphlet is standard size, 6x9 inches.

The Blanchard Machine Company, of Boston, Mass., has sent us catalog describing and illustrating disintegrators for reducing and grinding friable materials. The catalog is standard size, 6x9 inches.

HOLDERS WITH INSERTED CUTTERS,

For turning, cutting off, threading, shaping and boring metals. The cutters are inexpensive and may be sharpened by grinding, without changing the form.
MILLING CUTTERS, in variety, carried in stock and made to order. Punches and Dies for plate work. Taps, Dies, Reamers, Gauges.

ASK FOR THE MACHINISTS' CATALOGUE.

The Pratt & Whitney Co., Hartford, Conn., U. S. A.

NEW YORK, 128 Liberty Street. BOSTON: 144 Pearl Street. CHICAGO, 42 South Clinton Street. LONDON, ENG., Buck & Hickman, 280 Whitechapel Road. PARIS, FRANCE, Fenwick Freres & Co., 21 Rue Martel.

ENGINE and SPEED LATHES

IN VARIOUS LENGTHS—9 to 15 in. SWING. Latest and Most Approved Designs. Workmanship, Material and Finish of the Highest Order.

SEBASTIAN LATHE COMPANY,

117 and 119 Culvert Street CINCINNATI, OHIO, U. S. A.

Agents: SELIG, SONNENTHAL & CO., London, Eng.; JOHN TRAGARDH & CO., Göteborg, Sweden; E. SONNENTHAL, JR., Berlin, Germany; R. S. STOKVIS & ZONEN, Rotterdam, Holland.

THE CALORIFIC POWER OF FUELS. With a very full collection of tables of heats of combustion of fuels, solid, liquid, and gaseous. By HERMAN POOLE,

8vo. Cloth. 40 figures, 279 pages. $3.00

JOHN WILEY & SONS, 53 East 10th Street, - New York City.

"Lightning" Screw Plates For Machinists, Electricians, Bicycle Repairers, etc. Adjustable Dies with Guides.

Send for Catalogue.

WILEY & RUSSELL MFG. CO.,
GREENFIELD MASS, U. S. A.

Agents in London, SELIG, SONNENTHAL & CO. 85 Queen Victoria Street.

Jenkins Standard '96 Packing

weighs 33-1/3 per cent. less, does not **Rot, Burn** or **Blow Out,** and will last longer than other joint packings; therefore the cheapest and best for all purposes.

Good buyers compare weights.
Genuine stamped like cut.

JENKINS BROS., New York, Boston, Philadelphia, Chicago.

ELECTRIC MOTORS

STANDARD OF THE WORLD.

To Drive Your Machinery and Tools?

GENERAL ELECTRIC COMPANY,

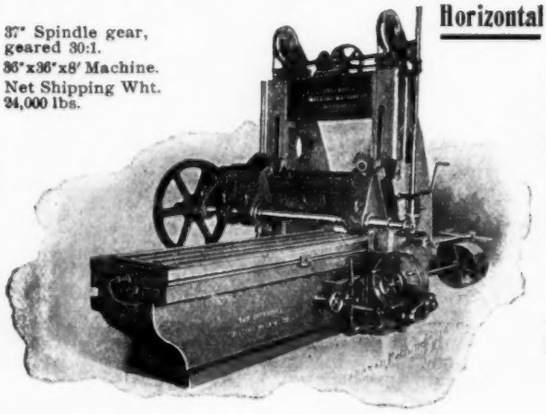
SCHENECTADY, N. Y.

Sales offices in all large cities of the United States.

HEAVY MILLING MACHINES EXCLUSIVELY.

Horizontal or Vertical Spindles or Both.

37" Spindle gear, geared 30:1.
36"x36"x8' Machine.
Net Shipping Wht. 24,000 lbs.



SIZES:
15", 20", 24", 36", 48", 60", any length.

Wide range of cutter speeds.
Variable table feed from 3-16" to 10" per minute.
Power elevating and lowering device.
Table adjusted by power in either direction.

Write for full information and prices to

The Ingersoll Milling Machine Co.
P. O. Box 2777,
ROCKFORD, ILL., U. S. A.

FOREIGN AGENTS:
C. W. Burton, Griffiths & Co., London, Eng.
A. Janssens, Paris, France.
DeFries & Co., Berlin and Dusseldorf.

EASTERN BRANCH,
126 Liberty Street, New York.

Cable Address: "Ingersoll," Rockford.

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DESIGNERS AND BUILDERS OF

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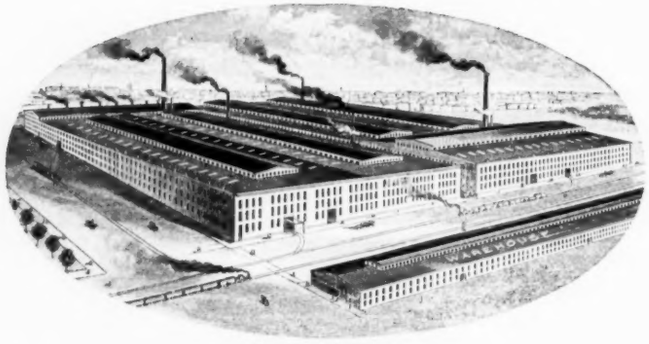

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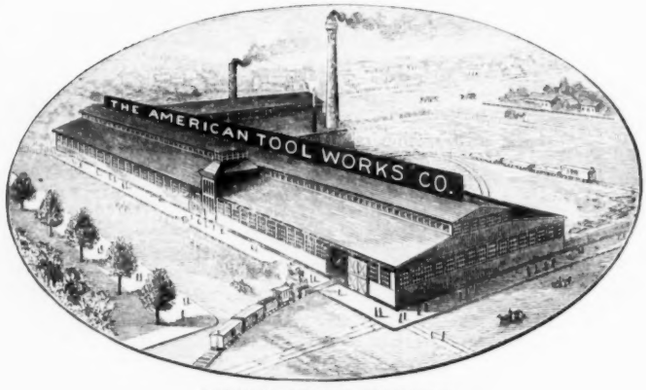

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☛ Orders first in receive precedence.

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1 20x10 Standard Lathe.
1 20x12 " "
2 22x18 " "
1 24x10 " "
2 24x12 " "
1 28x10 " "
1 28x16 " "
1 30x14 " "
1 36x10 " "

SCREW MACHINES.

6 No. 1 (works 5/8 in. stock).
1 No. 5 " 1¾ " "
1 No. 6 " 2⅛ " "
1 No. 7 " 2⅝ " "

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4 60 in. Radial Drills.
1 5 ft. Full Universal.
2 42 in. Standard Drills.
3 36 " " "
5 32 " " "
6 28 " " "
6 25 " " "
5 25 in. Challenge Drills.
6 25 " National Drills.
6 22½ " " "
6 21 " " "
12 13 " Sensitive Drills.
12 14 " " "

BRASS-WORKING TOOLS.

6 12x4 Monitor Lathes.
2 14x5 " "
2 16x5 " "
1 20x7 Cabinet Turret.
1 15x5 Universal Monitor.
4 15x5 Set-Over Lathes.
6 Cock Grinders.
1 37 in. Boring Mill.
1 26x26x8 Planer.
2 28 in. Geared Shapers.
6 Lincoln Millers.
6 No. 1½ Hand Millers.
6 ⅜ in. Punch and Shears.
4 5/8 " " " "
6 Univ. Cutter Grinders.
2 2 in. Auto. Bolt Cutters.

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200 Standard Engine Lathes, ranging from 12 to 60 inch Swing.
150 Drill Presses from 12 to 42 inch Swing.
50 Milling Machines, Plain and Universal.
40 Iron Planers, 22, 24, 26, 30, 32, 36, 42 inch Square.
40 Screw Machines, 7 sizes, 5-8 to 2 5-8 inch stock.
30 Monitor Lathes, 12, 14, 16, 18 and 20 inch Swing.
20 Chucking Machines, 22 and 36 inch Swing.
18 Bolt Cutters, 1½ and 2 inch Swing, Single and Double Head.
12 37-inch Boring and Turning Mills.
6 5 and 6 foot Boring and Turning Mills.
24 5 and 6 foot Radial Drills.

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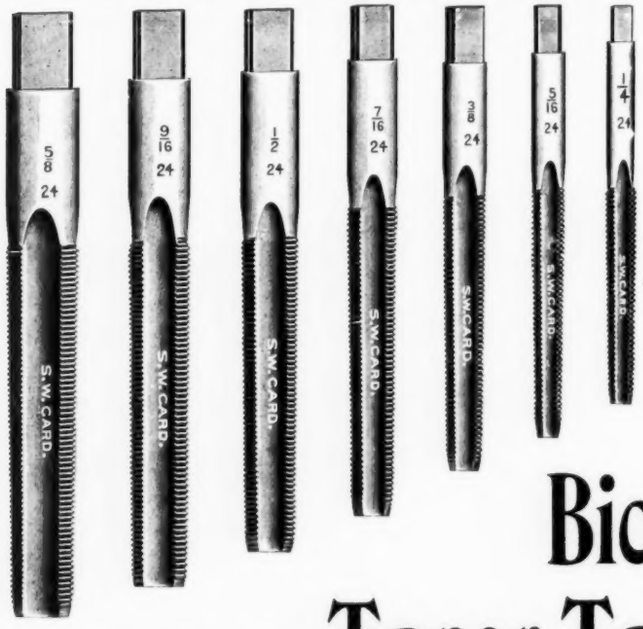

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Flather Planers

Have been designed to meet the requirements of manufacturers who want a heavy, solid machine, which is also as handy as those of lighter weight, and have met these requirements fully and satisfactorily.

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Niles Tool Works, New York.
Garvin Machine Co., New York and Philadelphia.
Chas. Churchill & Co., London.
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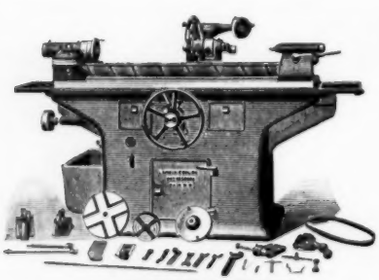

No. 3 UNIVERSAL GRINDER.
12 inch swing; 42 inches between centers.

GRINDING MACHINES,

Universal and Plain.

EIGHT SIZES.

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Waynesboro, Pa., U. S. A.

Agents: Hill, Clarke & Co., Boston and Chicago; Walter H. Foster, Mgr., New York; C. W. Burton, Griffiths & Co., London; Adolphe Janssens, Paris; Schuchardt & Schutte, Berlin and Vienna.

A FINE LOT OF SECOND-HAND MACHINERY
Just Secured, All A1

LATHES.

62 in. x 22 ft. Putnam Mach Co., triple gear., heavy pat.
50 in. x 20 ft. Fifield, triple geared, 4 chuck jaws fitted, nearly new.
30 in. x 16 ft. Pond, C. rest and P. C. feed.
22 in. x 18 ft. Pond, C. rest and P. C. feed.
20 in. x 8 ft. New Haven, C. rest and P. C. feed, has hollow spindle.
18 in. x 8 ft. New Haven, C. rest and P.C.fd., has chuck.
17 in. x 6 ft. Perkins, plain Gib rest.
16 in. x 9 ft. Hendey-Norton, all attachments, latest pat.
2 16 in. x 8 ft. Bogart, elevating carriage, weight rest.
2 14 in. x 6 ft. Bogart, elevating carriage, weight rest.
2 14 in. x 6 ft. Reed, raise and fall rest.
2 14 in. x 6 ft. Lodge & Davis, C. rest and P. C. feed, 1 in. H S.
10 in. x 5 ft. Reed raise and fall rest, with 2 chucks.

PLANERS.

104 in. x 60 in. x 16 ft. Detrick & Harvey, style F, open side, extension with 4 heads, nearly new.
56 in. x 56 in. x 18 ft. Gray, with 3 heads, latest pattern.
42 in. x 42 in. x 12 ft. Gleason, with 4 heads, good as new.
36 in. x 36 in. x 10 ft. Gray, with 2 heads, A1.
30 in. x 30 in. x 8 ft. Wilson, 1 head, nearly new.
30 in. x 30 in. x 8 ft. N. Y. Steam Eng. Co., with 1 head.
26 in. x 26 in. x 7 ft. New Haven, one head, all attachts.
24 in. x 24 in. x 6 ft. Lodge & Davis, one hd., heavy pat.
24 in. x 24 in. x 5 ft. Gray, latest pattern, nearly new.
15 in. x 15 in. x 12 in. Blaisdell crank, with chuck.

SHAPERS.

25 in. stroke, Gould & Eberhardt, adjustable crank, heavy pattern.
24 in. stroke, Hendey friction, medium pattern.
17 in. stroke, Prentiss, adjustable crank, fine order.
2-16 in. stroke, Gould & Eberhardt, adjustable crank latest pattern.
2-16 in. stroke, Hendey friction, latest pattern.
13 in. stroke, Warren traveling hd., 2 tables, fine order.

DRILLS.

6 ft. arm Putnam radial, heavy pattern.
4 ft. arm Betts radial, good as new.
3 ft. arm Betts radial, good as new.
36 in. swing, N. Y. Steam Eng. Co., B. G's and P. feed.
32 in. swing, Pratt & Whitney, B. G's and P. feed.
28 in. swing, New Haven, B G's and P. feed.
26 in. swing, Prentice Bros., B. G's and P. feed.
2 21 in. swing Prentice Bros., B. G's and wheel feed.
20 in. Barnes, wheel feed and Q. R.
1 each 1, 2, 3 and 4 spindle, sensitive.
Dallett portable drill.
2 Stow flexible shaft drills, with attachments.

MILLING MACHINES.

No. 3 Hilles & Jones vertical, heavy pattern.
No. 2 Cincinnati Universal, tool room, latest pattern, has vertical attachments.
No. 4 Garvin, plain back geared with centers.
No. 2 Garvin, plain without arm or back gears, all attachments.
No. 1 1-2 Garvin, plain without arm or back gears, all attachments.
No. 2 Newton, plain, B. G's, table 40 in. long.
No. 2 Brown & Sharpe, plain, B. G's, heavy pattern.
No. 2 J. L. Bogart, double column, plain, back gears.
Warner & Swasey, 4 spindle valve miller all attachments, nearly new.
36 in. Brainard, full Universal gear cutter, fine order.
25 in. Gould & Eberhardt, full aut. gear cutter.

SCREW MACHINES.

No. 3 Pratt & Whitney with W. F., aut. turret feed, all attachments.
No. 3 Pratt & Whitney, same attachments, except no automatic turret feed.
No. 2 1-2 Pratt & Whitney, fricton hd., drawing spindle.
No. 2 Pratt & Whitney, wire feed and all attachments.
No. 1 Windsor, with wire fd., a lot of chucks and tools.
No. 1 Jerome & Secor, with wire feed and all attachts.
2-15 in. x 2 ft. 6 in. Pratt & Whitney, screw shavers, all attachments.

PRESSES, SHEARS AND HAMMERS.

Heavy triple geared double column power press, weight 32 tons, bed 8 1-2 ft. long x 4 ft. wide, 3 in. stroke, very heavy.
No. 61 Bliss armature notching press, with dial feed and lot of dies.
5 Double housing power presses, 20 in. bet. housings, hole in bed 10 in. x 13 in., weight about 6,500 lbs., similar to No. 75 Stiles.
3 No. A3 Ardle power presses, hole in bed 5 x 5, weight 4,000 lbs.
No. 5 Eaton power press.
7 ft. geared squaring shear, very heavy.
1,000 lb. Bement steam hammer, nearly new.
600 lb. Bement steam hammer, in good order.
125 lb. Beaudry power hammer.

BORING AND DRILLING MACHINES.

6 ft. Michel vertical boring and turning mill, 2 heads.
5 ft. Bement vertical boring and turning mill, 1 head.
42 in. Bullard vertical mill, has taper attachments and screw cutting device and chuck jaws.
37 in. Bullard mill, 2 heads, and chuck jaws, latest pat.
Style C Newark hor. bor and drilling mach., 3 in. bar.
56 in. x 12 ft. bed Nicholson & Waterman hor. bor. mach.
70 in. x 16 ft. Whittier horizontal bor. mach., old style.

MISCELLANEOUS.

2 in. Sellers auto. bolt cutter, full set taps and dies.
1 1-2 in. National aut. bolt cutter, full set taps and dies.
1 1-4 in. Adams aut. bolt cutter, 4 sets of dies.
6 in. Bement slotter, all feeds.
One each, 49 and 33 in. Bullard armat. winding lathes.
10 in. Putnam slotter, all feeds.
2 Lee & Hunt cold sawing machines with eng. attached.
Pratt & Whitney metal band saw.
Also a lot of small tools, pulleys, shafting hangers and belting used in connection with above machinery.

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12 in. x 5 ft., Reed & Prentice.
13 in. x 6 ft., Ames Manufacturing Co.'s.
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16 in. x 6 ft., Fitchburg, taper attachments.
16 in. x 7 ft., Pratt & Whitney.
18 in. x 8 ft., Flather, cpd. rest.
20 in. x 10 ft., Putnam, cpd. rest.
21 in. x 9 ft., Lodge-Davis, taper attachments.
22 in. x 10 ft., Pond, cpd. rest.
24 in. x 12 ft., Putnam, cpd. rest.
26 in. x 10 ft., Fifield, cpd. rest.
32 in. x 18 ft., Fay & Scott, cpd. rest.
40 in. x 20 ft., Pond, exra heavy.
90 in. x 20 ft., Triple geared, extra heavy.

PLANERS.

22 in. x 5 ft., Putnam.
24 in. x 6 ft. Lodge-Davis.
26 in. x 6 ft., Pond Machine Tool Co.
30 in. x 8 ft., Gray Co's. latest pattern.
36 in. x 8 ft., Bement.
38 in. x 8 ft., New Haven.
48 in. x 16 ft., Putnam.

SHAPERS.

12 in. stroke Crank, Gould & Eberhardt.
15 in. stroke Friction, Prentiss.
16 in. stroke Crank, Gould & Eberhardt.
24 in. stroke Friction, Hendey.
24 in. stroke Crank, Gould & Eberhardt.

DRILLS.

Sensitive Drills, various kinds.
20 in. Swing Barnes, hand feed.
21 in. Swing Prentiss, back geared.
22 in. Swing Barnes, back geared, automatic feed.
26 in. Swing Lodge-Davis, complete.
28 in. Swing Barnes complete.
32 in. Swing Prentiss, complete.

RADIAL DRILLS.

72 in. Swing, complete tapping attachments.
120 in. Swing Bement Semi-Universal.
110 in. Swing, Baush, latest.

MILLING MACHINES.

Universal Kempsmith, tool size.
Universal Cincinnati No. 3, back geared.
Universal Brainerd No. 15, tool size.
Plain No. 2, Kempsmith, latest.
Plain No. 12, Garvin, with arm.

SCREW MACHINES.

1 5-16 in. wire feed, Jones & Lamson, latest.
1 9-16 wire feed, Garvin, friction head and turret feed, complete.
2 1-8 in. wire-feed, Jones & Lamson, friction head and turret feed, complete.

MISCELLANEOUS.

Automatic Gear Cutter, 36 in., Gould & Eberhardt.
Cutting-off Machines, 2 and 3 in.
Bliss Press No. 19.
Stiles Presses, No. 2, 3 and 4.
Sellers Horizontal Boring and Drilling Machine.
Hilles & Jones Punch and Shears.
Bending Rolls, 6, 8 and 14 feet.

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8 IN. RIVET PRECISION LATHE,

with automatic cross feed compound rest, milling and grinding attachments, spring chucks, counter and other small fixtures. Used but a few weeks. Send for details.

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One Hornsby-Akroyd Oil Engine of 30 H. P. Has been run only a short time, and guaranteed as good as new. To be sold only for the reason that we have put in a much larger Engine, which renders its continued use unnecessary.

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FOR SALE.

ON ACCOUNT OF CHANGES TO BE MADE.

1 Worthington Steam Pump, size, 14 x 8½ x 10.
1 Knowles Automatic Feed Pump and Receiver, B size.
1 Pitkins Bros. Feed Water Heater, 40 horse-power.

All in perfect condition and now in use at

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FOR SALE.

54 in. x 48 in. x 24 ft. second-hand Iron Planer, made by the Hercules Iron Works, in good working order.

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59-61 S. Canal St., Chicago, Ill.

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1 14 in. x 3 ft. 6 in. Putnam.
5 14 in. x 6 ft. F. E. Reed.
1 15 in. x 6 ft. Star.
1 15 in. x 6 ft. Wood & Light.
1 16 in. x 5 ft. Ames.
1 16 in. x 7 ft. Dustin & Hubbard.
1 18 in. x 8 ft. Dustin & Hubbard.
1 21 in. x 9 ft. Pratt & Whitney.
1 24 in. x 13 ft. Lathe & Morse.
1 27 in. x 10 ft. Dustin & Hub.
1 28 in. x 12 ft. Wood & Light.
1 32 in. x 13 ft. Bement.
1 48 in. x 18 ft. G. & S.
1 Pit Lathe, 72 in. x 18 ft.

PLANERS.

2 16 x 16 in. x 4 ft. Hendey.
1 24 x 24 in. x 6 ft. Powell.
1 24 x 24 in. x 7 ft. Lathe & Morse.
1 28 x 28 in. x 8 ft. G. & S.
1 30 x 30 in. x 10 ft. Niles.
1 32 x 26 in. x 14 ft. grade, 2 hds.
1 36 x 36 in. x 12 ft. Powell, 2 heads.
1 36 x 36 in. x 18 ft., Wm. Sellers.
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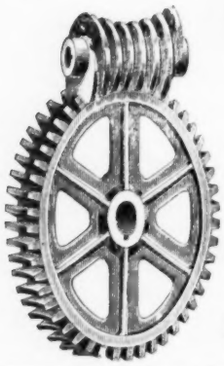

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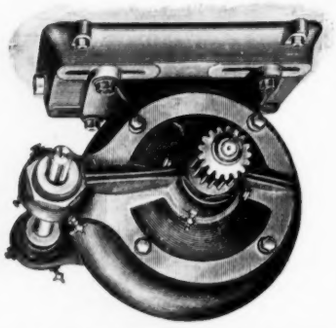

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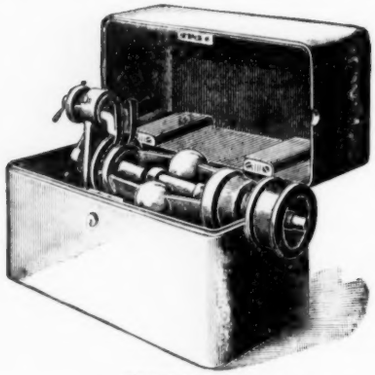

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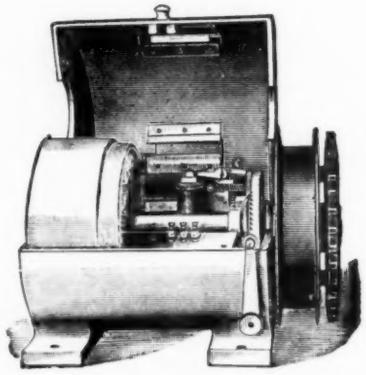

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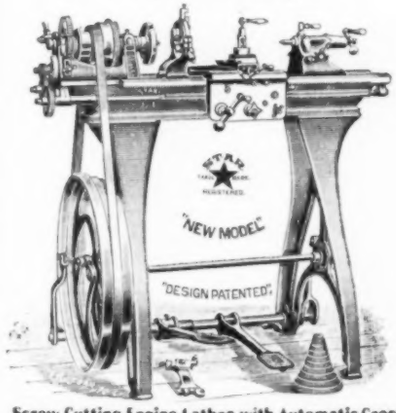

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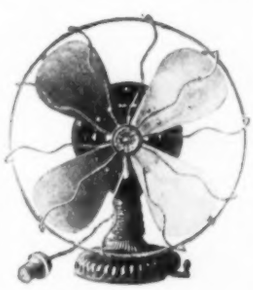

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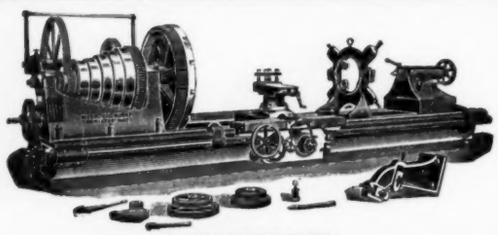

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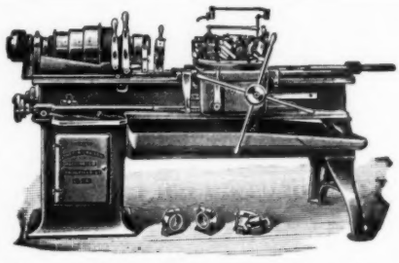

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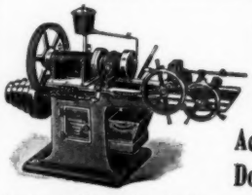

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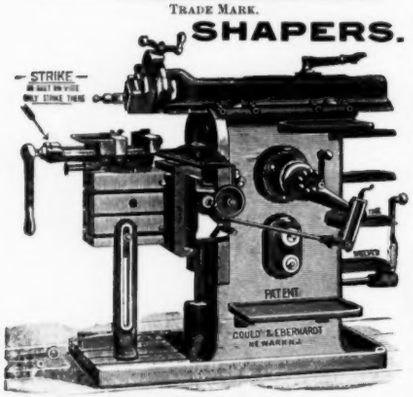

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